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Prospect

From the point of vantage of forty volumes completed POPULAR ASTRONOMY looks forward. Indulging in personification a little longer, POPULAR ASTRONOMY at the beginning of its forty-first year looks out upon a vastly different universe, at least one thought of very differently, from that into which it was introduced forty years ago. It uses a new vocabulary. The word *electron* was then used to designate amber. Now it has a different connotation and has as associates *proton, neutron, photon,* words not known then. Within the relatively brief span of its existence *galaxy* has been pluralized and *super-galaxies* has been added. Also entire new bodies of thought have been developed, relativity, quantum theory, wave-mechanics, the expanding universe.

At first thought it might seem that *popular* astronomy no longer exists and that technical and specialized astronomy has taken its place. Surely the new words and the new ideas appear extremely formidable to the uninitiated. However, the increase in intellignce on the part of the general reader has kept pace with the increase in complexity of the new theories. The public in recent years has become astronomically and scientifically conscious in this country as well as in other countries. As a result many persons are now capable of reading intelligently such treatises as a generation ago would have been within the reach of the elect only.

It is true that POPULAR ASTRONOMY may in its forty-first year contain material which in its first year would have been contradictory to its name. Nevertheless POPULAR ASTRONOMY still may stand as an intermediary between the research astronomer and the amateur who wishes to know. This has been its professed policy during forty years.

It enters upon its forty-first year with the same purpose.

The Portsmouth Works

By STANSBURY HAGAR

This paper attempts to show that the most extensive and important earthworks of the Mound Builders of the Ohio Valley reveal an astronomical design and were in fact an astronomical temple.

Until about a century ago a series of earthworks approximating ten miles in length extended through the city of Portsmouth, Ohio, the adjacent country on the east, and two parts of Kentucky across the Ohio River. These earthworks were constructed by the unknown pre-Columbian people whose remains cover the Ohio and Mississippi valleys

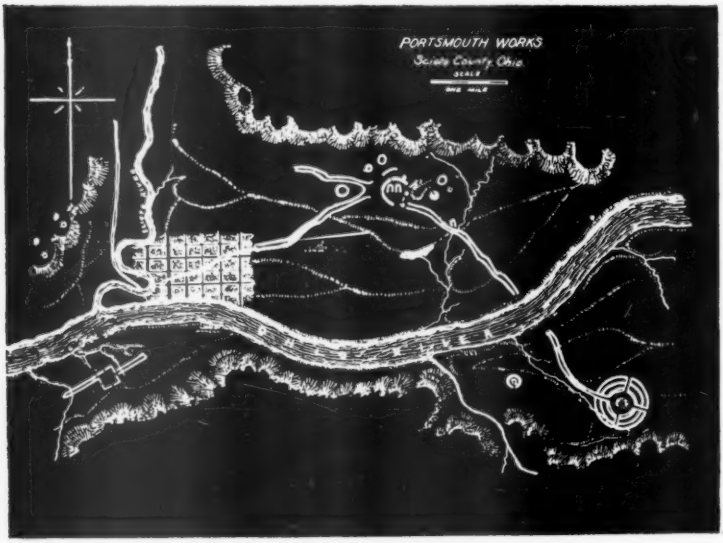

FIG. 1. PLAN OF THE PORTSMOUTH WORKS.

and a large part of the adjoining states. They were known to the early settlers as the Portsmouth Works and consisted of four concentric circles towards the east in Kentucky, whence a curved avenue, formed by two parallel walls, extended to the Ohio River, and from the opposite bank to and through the city of Portsmouth, back to the river and from the opposite bank to a square and two adjoining avenues, where it terminated (Fig. 1). These constructions have now been entirely destroyed except a horseshoe-shaped mound preserved by the wisdom and generosity of Dr. Hempstead, and a group of small mounds near the center of the main avenue, some formless remains in the nearby

cemetery, and the square at the western end.

But the plan of the works has been definitely established by three independent surveys made by competent surveyors while the works were still complete or nearly so, and these surveys agree except in minor details.[1]

Among the thousand groups of earthworks erected by the Mound Builders the plan of the Portsmouth Works is unique. Most of all of them it challenges attention by the striking peculiarity of its design. It suggests to the eye the figure of a gigantic serpent curving like a bow from the four circles at its head to the square and smaller avenues at its tail, which are almost due west of the head.

In 1851 Squier wrote that the avenue might actually represent a serpent and be associated with sun worship[2] and Peet writing half a century later "did not insist" that it represented a serpent but regarded the four circles as a sun symbol and the crescent mound near the center as representing the moon. Squier alone offered details in support of his opinion. No one else has attempted to explain the plan or purpose of the Works, but it now seems possible to do this with reasonable certainty and with the aid of subsequently discovered archaeological material. The results, if correct, will lead to a greater appreciation of the importance of the Portsmouth Works and they will help to cast light on the thought and culture of the still mysterious Mound Builders.

This interpretation will be supported by groups of similar and identical symbols used with various and definite significance by the Mound Builders themselves and found in the Portsmouth Works and other mounds far and near. The interpretation of these symbols in turn will be supported by analogous symbols in use among the Maya and Mexicans of Central America, whose culture is now generally believed to have influenced the art of the southern Mound Builders directly or indirectly.[3] And, finally, these symbols will be compared with those now or recently in use among the Indian tribes whose ancestors may have been in contact with the Mound Builders or with other tribes influenced by them.

What was the purpose of the Works? Numerous utilitarian explanations have been offered, all of which have encountered insuperable objections.

Apparently then, our only recourse is to ascertain whether the plan of the Works reveals a definite design; if so, what was its significance, and does that significance provide an adequate motive to explain the enormous labor expended on the Works as a whole. For that purpose let us begin these studies with a more detailed examination of the plan

[1] Fig. 1, Squier and Davis, 1851, Pl. XXVII, pp. 77-82; Hempstead, 1875, Folder, and p. 4; Atwater, 1820, opp. p. 152.

[2] 1851, p. 240. I am indebted to this work for much information regarding serpentine remains in England.

[3] Putnam and Willoughby, 1896, pp. 302-307, Fowke, 1902, pp. 50, 687, 723. Shetrone, 1930, pp. 486-487.

of the Works. As the activities of the Mound Builders followed the rivers, because the rivers afforded the principal means of communication, also, perhaps, because of the level, unforested meadows beside them, a glance at the map shows us that the Works of the Ohio Mound Builders should have centered in and around the present city of Portsmouth for there the Scioto and Ohio Rivers meet. The Scioto is the largest northern tributary of the Ohio with an extensive and fertile watershed, dotted with numerous mounds, while the important mounds and mound groups along the Ohio River point to it as the main artery of Mound Builder intercourse east of the Mississippi. East of this river junction on the Ohio side the river hills, which elsewhere approach close to the Ohio, recede towards the north, forming a level plain approximately five miles long and several miles wide, now almost covered by the city of Portsmouth.

The hills on the Kentucky side of the Ohio also recede opposite the eastern and western portions of this plain.

Over these three plains until recent times the Portsmouth Works extended, obviously intended to form a continuous figure, the most extensive in the entire area of the mounds. In Kentucky on the east were four concentric circles having a small circular mound at the center whence four avenues radiated approximately to the cardinal points, dividing each circle into four segments. The outer circle was about ¼ mile in diameter. The western avenue was prolonged in a sweeping curve northwesterly 1¼ miles ending at the second terrace of the Ohio River and becoming the most important feature of the Works. It was formed by two parallel embankments averaging 160 feet apart, four feet in height and twenty feet wide at the base. This avenue began again on the bank directly across the Ohio River and continued northwesterly with a series of sinuous curves about 2¼ miles, terminating again before a curious group of mounds which extended from the present site of the Children's Home into the cemetery west of it. This group occupied the approximate center of the Works. It included a crescent which enclosed two horseshoe-like mounds, eighty feet long and seventy feet wide placed side by side and it was also associated with seven or eight small circular mounds, apparently distributed irregularly, and a small curved embankment. Beside the northeastern end of the crescent there was also a trace of what may have been another avenue, extending towards the northeast. From a point west of the crescent two avenues issued. One extended about a mile towards the west. The other, the western continuation of the main avenue, stretched, again in sinuous curves, southwest approximately three miles with a short turn southward near the western extremity that brought it back to the Ohio River. Almost at the point where it entered the limits of the city of Portsmouth as they existed eighty years ago, its width narrowed from 160 to 70 feet and so continued for the remainder of its extent.

Across the Ohio in Kentucky, again at a point almost opposite the

western termination of the avenue in Ohio, but nearly half a mile from the river, there was another group of earth works comprising a square with rounded corners enclosing about fifteen acres with walls about twelve feet high and twenty-seven feet wide at the base, whence two short straight avenues extended about a half mile each towards the northeast and southwest, giving this group a total length of about 1¼ miles. But, though the Plan of Squier and Davis shows a hiatus of nearly half a mile between this group and the river, Dr. Hempstead, a lifetime resident of Portsmouth and a careful student of the Works, asserts that this group was connected by parallel walls with the river and so with the central group in Ohio, and Mr. Charles V. Wertz, of Portsmouth, an authority on the Works, saw traces of such connecting walls in his boyhood. So we may safely conclude that the group in Kentucky formed part of the Portsmouth Works.

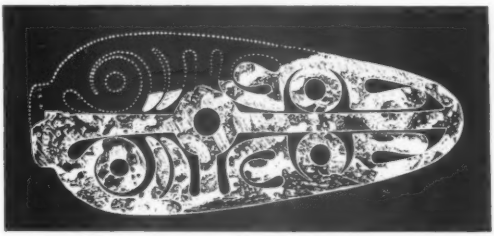

Fig. 2. Copper Serpent's Head from the Hopewell Mound.

The total length of the main avenue as represented in Squier and Davis' Plan and including the avenues at the tail is about eight miles, but if we include the missing parts of the avenue, which doubtless have been destroyed, and the two crossings of the Ohio River its length is ten miles.

The secondary avenues at the head and center and the walls of the four circles and the crescent mound contributed about six miles to the length of the earthworks, so that if we double the length of the avenue, for the double wall, and add the earthworks just named, the total length of the earthworks in the Works was over 24 miles.[4]

The dimensions of the Works indicate the tremendous labor involved in their construction by a people who, to the best of our knowledge, conveyed thither the whole of the necessary earth in wicker baskets. It is self evident that no such labor would or could be expended without some adequate motive and that the Works were not haphazard constructions but had some definite significance associated with that motive.

An unmistakable serpent head with four circles, central mound and

[4] For plan and description of Works see Squier & Davis, 1851, Pl. XXVII, pp. 77-82. Hempstead, Folder and p. 4. Atwater, 7820, opp. p. 152. Fowke, 1902, pp. 173-179; Mills, 1914, p. 73; For description see Peet, 1903, pp. 94, 248-253. Shetrone, 1930, pp. 260-1.

four intersecting avenues appears on a conventionalized copper design from the Hopewell Mound supporting the association of these features of the Portsmouth Works with the head of a serpent[5] (Fig. 2).

The elements of the design of the Works seem to be repeated on shell gorgets exhumed within the Works themselves[6] and in mounds of Georgia, Alabama, Kentucky, Tennessee, and Missouri (Fig. 3). The conventional design inscribed upon them represents a plumed rattlesnake coiled around the outer rim. The head is formed by concentric circles that surround an inner ring and are surrounded by an outer band with small circular dots at frequent and regular intervals. Plumes issue

Fig. 3. Shell Gorget from the Mounds.
(Courtesy of Dr. G. G. MacCurdy.)

from its head.[7] The body is marked by alternating circles and cross hatching representing scales. There is a large crescent at or near its center and the tail ends in a rattle. There are also rings on some of these gorgets beside the crescent and towards the center of the serpent.[8] On an engraved stone disk from Alabama they form an exterior band around the serpent's body in association with two crescents. On a gorget from Tennessee a single wing projects beyond the crescent.

Dr. MacCurdy describes gorgets from Tennessee which present holes in the outer rim in place of dots, (appropriate stellar symbols) and four avenues crossing the concentric circles. These he connects with the four cardinal directions.[9]

[5] See Moorehead, Report of the Bureau of Ethnology, Washington, Vol. XII, p. XXXIX. Figure reproduced in Fowke, p. 721.

[6] In collection of Mr. Charles Wertz of Portsmouth.

[7] Holmes, 1883, pp. 290-1; Putnam, 1896, p. 302; Squier & Davis, 1848, pp. 276, 301; Mills, 1914, p. 73. Fowke, 1902, pp. 49-51, 687-721; Peet, 1903, pp. 244, 295. Moorehead, 1904, pp. 88, 124, 127, Pl. LXVIII, No. 4. Gorgets of this character are found in many museums.

[8] See MacCurdy, 1915, Pl. III, opp. p. 78; Fig. 6, opp. p. 79.

[9] See MacCurdy, 1915, Pl. V, opp. p. 83. Shetrone, 1930, p. 135.

These gorgets were evidently suspended from the necks of dancers or other participants in ceremonies. They therefore possessed a sacred character and their numbers and distribution show that they formed a widely known design very similar, as stated, to that of the Portsmouth Works, for, as we shall see, every feature of the gorgets except the plumes and rattle, are reflected in the Works. The gorgets represent the winged or plumed rattlesnake, the most sacred symbol of Mexico and Central America.

A plumed and winged rattlesnake is figured on pottery from a mound in Moundsville, Alabama, and numerous figures of plumed serpents have been found in the Etowah Mounds of Georgia.[10]

The head of a plumed rattlesnake in stone was exhumed at Hopewell,[11] also two plumed intertwined rattlesnakes from a mound in northern Mississippi.[12] The Arapaho, Apache, Hopi, Zuni, and other Indian tribes of the United States still use the plumed serpent symbol.[13]

Though the serpent represents the course of the sun, not the sun itself, the daily rising of the sun in the east, its ascent toward the north, and descent toward the south and west readily suggested the swift, silent, sinuous motion of a snake which its annual north and south movement emphasized. The concept of time closely followed that of celestial motion and the annual death and resurrection of the serpent in autumn and spring with the annual shedding of its skin suggested naturally and simply the death and rebirth of the sun at the end and beginning of its annual course. So, in all parts of the world we find the serpent associated with the heavens and their daily and annual revolution, also with time and cycles of time. The serpent symbol has also many other meanings but that of celestial revolution appears to be predominant.

The Dakotas believed that far away in the unknown region of the south was the dwelling place of light marked by a great red circle. From it light streamed towards the north in a yellow band called the Yellow Road. This road was crossed at right angles from east to west by a great mystic or symbolic serpent marked with bands of black and yellow and called the Black Road.[14] The yellow road stretching from east to west was obviously the celestial road of continuous light, the Milky Way, which has a north-south trend during the greater part of the year and was generally known as the Celestial Road or Path in the traditions of North American Indians, the Ixtac Mixcouatl or White Cloud Serpent of Mexican tradition. The black and yellow serpent that crossed it from east to west can only have been the road of alternating space and stars, of darkness and light, that marked the course of the sun, moon, and planets among the stars.

[10] Moorehead, 1928, Abstract; Shetrone, 1930, p. 143; Peet, 1903, pp. 304, 305.
[11] Squier & Davis, 1848, p. 276. Fowke, 1902, p. 688.
[12] Field Museum, Chicago, No. 110483.
[13] Collections of the Brooklyn Museum and the American Museum of Natural History.
[14] Gilmore, 1896, p. 570.

The solar disc with four concentric circles segmented by four equidistant bars to the cardinal points and supplemented by four minor bars to the diagonal points, forms the typical sun symbol of the Mexican codices, while the moon is represented in crescent and horseshoe form surrounded by the dark night and its stars (Fig. 4, a, b).

The Maya sun glyph consists of a circular disc including two concentric circles, a small central circle and four equidistant rudimentary avenues. Their moon glyph presents a crescent horseshoe almost identical with the outlines of the Mexican symbol (Fig. 4, c, d).

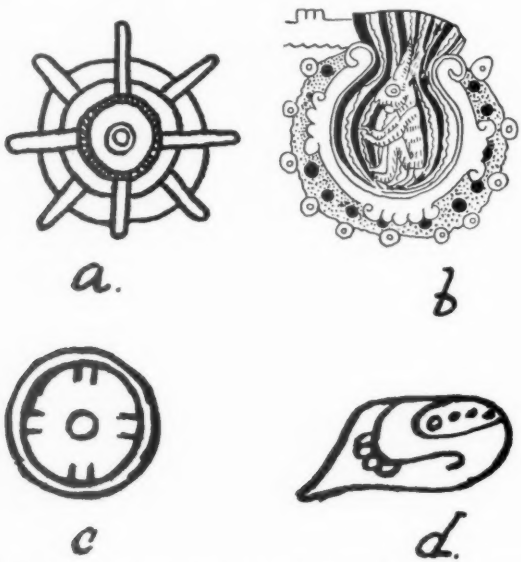

FIG. 4. MAYA AND MEXICAN SUN AND MOON SYMBOLS (CODICES).

Two serpents are placed on the circumference of the Mexican Calendar Stone representing the annual northward and southward course of the sun. The sun face is depicted at the center surrouded by a circle of day signs that represent the zodiac. The entire stone is a solar symbol with its concentric circles and eight spear heads marking the cardinal and diagonal points.

The celestial serpentine path is represented in nearly all the Mexican codices, for example on sheets 47 and 48 of the Vienna codex where it extends from the stars to the earth; Bodleian sheets 2, 6, 12, 26, 40, where footprints upon it signify the motion of the sun or other celestial body across the sky; Borgia, sheets 35 and 36, where a dark path covered with footprints passes between temples of night, surrounded by stars. It terminates in a temple filled with serpents and covered with

stars. Four deities walk upon it. Other celestial serpentine paths are seen in the Fejervary and Nuttall.

This symbolism suggests the Tzental myth of the deity Votan, son of a serpent and Lord of the twenty days of the calendar signs. He was therefore associated with the heavens. By means of his mystic knowledge he traveled through the body of a great serpent to the dwelling of the thirteen serpents in the land of the sky. These serpents were doubtless constellations, probably the thirteen signs of their zodiac.

In the Maya area the celestial serpentine path is equally conspicuous. As we approach that region the mural paintings at Mitla represent the sun with its concentric circles upon that path which passes among sym-

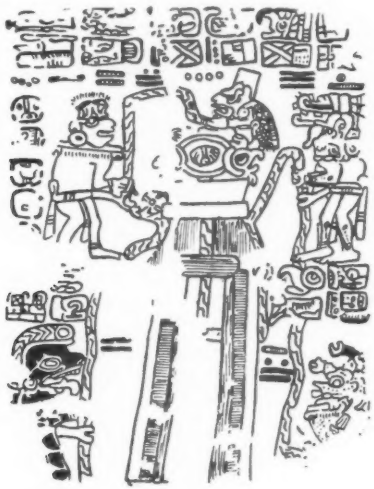

FIG. 5. ZODIAC AND SOLSTICIAL TEMPLE FROM THE PRE-COLUMBIAN MAYA CODEX CORTESIANUS.

bols of the zodiacal constellations under a border of star symbols. On the mural within the Maya Temple of the Tigers at Chichen Itza, the sun, with its circles and spear heads, appears upon the serpentine band of the ecliptic. A procession of deities passes along the ecliptic to worship the sun god seated on his jaguar throne within the solar disc.

On sheet 19 of the Cortesianus (now Madrid), one of the three pre-Columbian Maya codices which escaped destruction at the hands of Bishop Landa, the serpentine rope of the ecliptic extends up and down in the center of the tableau.[15] (Fig. 5.) Five deities grasp it, or are attached to it in its course and the sun, denoted by the kin or sun glyph,

[15] Without suspecting its zodiacal significance Dr. J. W. Fewkes in 1895 correctly interpreted the meaning of the solar path and temple; the only previous attempt to explain this sheet.

is moving over it beside the roof of a temple on the left. Entering the tableau in the lower left corner, the rope first passes the black god of the sowing season and the cacao ritual of Muan, twenty day period under our Taurus.[16] The glyph over his head is probably Cib, day sign pertaining to Taurus.[17] Above him stands the Lord of the Collar whom the sequence of position identifies with Gemini and with Kukulcan, the Mexican, Quetzalcoatl, Celestial Twin. The akbal or darkness sign on his forehead probably refers to the descent of the sun into the southern signs of lesser daylight, which begins under Gemini.

The rope attains its highest point between this and the following figure, thereby representing the meridian of the site of the drawing. It then passes on northward (but descends from the viewpoint of the site) to the summer solstice in Cancer. In so doing it enters and passes through a temple on the roof of which a turtle is placed. This is the symbol of the summer solstice which occurs in the uinal or twenty day period Kayab whose name and glyph refer to the turtle, under our sign Cancer.[18] The yax sign on his back signifies the strength of the solar rays and the fresh green vegetation at this season. This temple of the Turtle has the same significance as the temple of the same name at Uxmal and that of the Turtle Sun at Palenque.[19] The turtle deity is shown over the figure of the turtle with his carapace on his back and wearing on his head a hat similar to that worn by the chief priest before the altar in the Temple of the Turtle Sun.[20] It is probably a symbol of the presiding deity of the Cancer ritual impersonated by his priest.

These symbols evidently refer to the Ac Ek, Turtle Asterism, of Cancer.

The serpentine rope now leaves the temple, ascends to the meridian of the site of the codex, then turns downward to the right hand corner of the drawing, passing two more deities. Above is the figure known to us as God B distinguished by his peculiar headdress involuted in front and by his pendant nose. His day sign is Ik, breath, life, pertaining to Leo.[21] His face, in this representation is probably that of the jaguar god, ruler of the Jaguar Asterism, our Leo. Below him is the turtle head of Kayab which should be attached to the Cancer section of the rope on the left. Below it at the top of the last section of the rope is the day glyph Cimi or Death pertaining to the Maya Zinaan Ek, Scorpion Asterism, our Libra-Scorpio. This double sign of the Maya

[16] Landa, Brasseur ed, 260, and note 1, Genet ed., Vol. II, p. 83.
[17] Hagar, 1910, pp. 140-143.
[18] This association of Cancer with the summer solstice in the Maya zodiac, owing to the procession of the equinoxes which has now caused the actual solsticial point to retrograde through Gemini to the boundary of Taurus, implies as in our own zodiac, that the original of each was established at least 3000 years ago. Such a date is not impossible for Mayan culture especially if their zodiac was acquired from foreign sources.
[19] Hagar, 1921, p. 6; 1928, pp. 204, 205.
[20] Also in the Temples of the Cross and Foliated Cross.
[21] See Schellhas, 1904, p. 19.

zodiac presided over rites in honor of the dead. Accordingly we find in the right corner the Death God with the body and claws of a scorpion. Only the front or Libra part of the Scorpion appears, however.

The entire drawing represents the serpentine ecliptic passing through the solsticial temple and six signs from Taurus to Libra, Virgo only being omitted in the drawing, perhaps for lack of space. The picture includes half of the zodiac.

A Maya mural painting of pre-Columbian date, recently uncovered on the walls of a pyramid at Santa Rita in British Honduras, also reveals the serpentine rope of the ecliptic passing among the deities of the

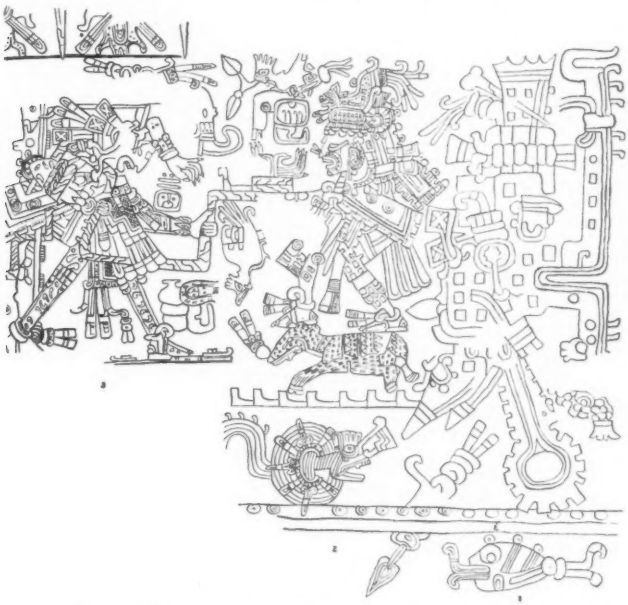

FIG. 6. PORTION OF THE MAYA ZODIAC AT SANTA RITA.

Zodiacal asterisms whose wrists are tied to it (Fig. 6). These deities constitute a complete zodiac in sequence beginning with Gemini on the right and, under Cancer, the next figure on the left, the ecliptic makes an up and down turn as in the Cortesianus codex.[22] But for our purpose it suffices to show a portion of the zodiacal serpent, and in passing, the group of asterisms under Gemini may not be without interest. Beneath the feet of the Gemini deity we see the Lesser Dog, correctly placed, and under it a line formed of figures like the cogs of a wheel, accidentally or otherwise, occupies the position of the celestial equator. Under the Dog, in turn, the head of a plumed serpent projects through the typical

[22] Hagar, 1915, p. 212, and Plate I, fig. 2.

eight rays and concentric circles of the solar disc, as in the figure used in the ritual of the Hopis of Arizona, and behind the disc the serpent's body extends in a sinuous course. If the head of the serpent were placed to the left of the Dog instead of beneath it, both head and body would occupy the position of our Hydra and the curve of both the disc and the body of the Maya Serpent would be duplicated in our constellation in the same position. Curious indeed that this correspondence should extend also to the configuration of the Portsmouth serpent.

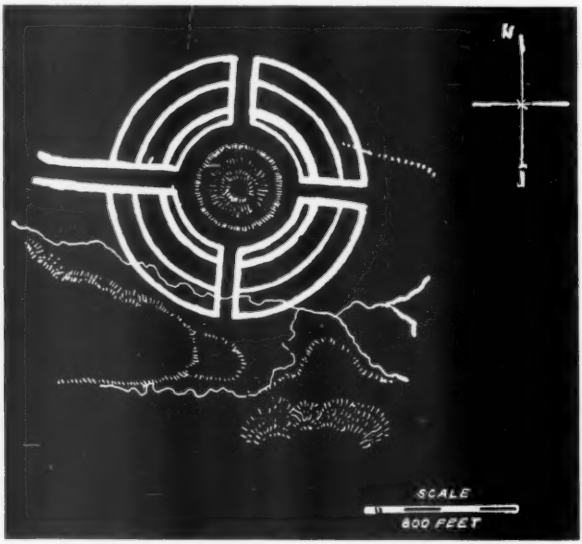

Fig. 7a. Sun in the Portsmouth Works.

But to return to Portsmouth.

Four concentric circles segmented by a cross, or with rayed exterior, form a well-known symbol of the sun frequently figured from the Maya and Mexicans northward to the mounds.[23] It is one of the most prominent symbols of the Mound Builders, "from which were derived most of the decorations on the mound pottery of the Mississippi Valley." It is still the sun symbol of the Ojibwas and is used by the Omahas and Dakotas. "It seems probable," writes Mr. Willoughby, "that this design which we find carved on shell, painted on pottery, and occasionally wrought in copper, was closely associated in pre-historic times with sun or fire worship. Sun worship, as is well known, constituted an import-

[23] Symbolic Survey of Middle Am. Art., Mexican Hall, Am. Museum of Natural History.

ant part of the religion of the historic tribes of the central Mississippi region."[24]

Passing now to the crescent mound in the central district at Portsmouth, the crescent symbolized the moon throughout the art of the American Indians, since the moon is the only conspicuous object that, for them, assumed the crescent form (Fig. 7b). Crescent shaped mounds are quite numerous among the remains of the Hopewell culture to which the Portsmouth Works are believed to pertain.[25] Crescent shaped objects of mica are often found in the mounds. In one mound Squier and Davis found a layer of silvery mica sheets laid in the form of a

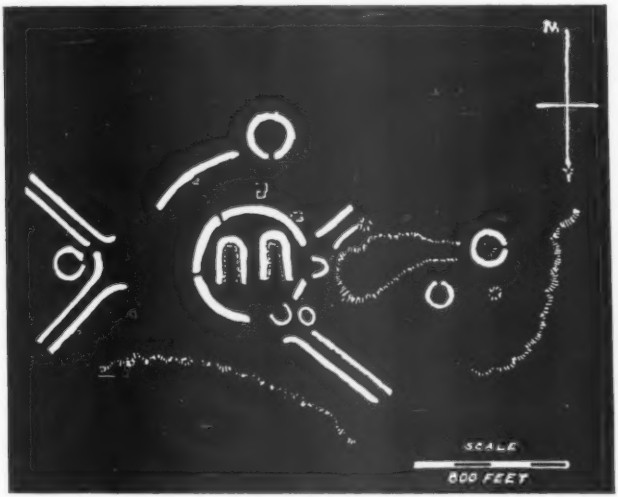

FIG. 7b. MOON AND STARS IN THE PORTSMOUTH WORKS.

crescent twenty feet in length from horn to horn and they suspected its connection with lunar worship.[26] Peet surmised that the mica may have been associated with the moon because of the resemblance of its reflected light to moonlight. This would parallel the dedication of silver to the moon in the southern culture area.

The crescent moon and stars are figured on Pawnee ceremonial drums and a Dakota buffalo robe.[27]

As for the horseshoes within the crescent, probably no one will deny that the American Indians are acute observers of all features of nature. They could easily have perceived with their unaided eyes two dark

[24] Willoughby, 1897; Shetrone, 1930, p. 139; Am. Museum of Natural History, and Museum of the American Ind. collections.
[25] Shetrone, 1930, pp. 34, 188.
[26] 1848, pp. 149, 150. Fowke, 1902, p. 352, 702.
[27] Field Museum, Hall 4.

horseshoe-shaped markings on the surface of the moon, one in the southwest quadrant of the illuminated disc, the other near it but somewhat towards the north. They are formed by the sea of Nectar and the nameless sea southeast of it. Surely it is not fanciful to credit the builders of the Portsmouth Works with this observation associated with the crescent moon.

In the Portsmouth plan we are led to identify the small circular and irregularly placed mounds around the crescent with stars because their form is similar to that of the star symbols on the gorgets and in the Maya and Mexican codices and they occupy the position of the star symbols in those designs.

Dr. Hempstead asserts that the square near the tail of the Portsmouth serpent was a place of amusement.[28] The analogous symbolism seems to indicate that the serpent of the Works was supposed to be a rattlesnake for although the rattle is not represented in the Works, it appears on all the gorgets. But the rattle among modern Indian tribes has been connected with dancing because a rattle of gourd or other material was used to mark time in the ceremonial dances. It was especially used in the dances to bring the rains, its sound being supposed to imitate that of falling rain and thunder, hence by imitative magic it informed the Great Spirit of the people's need. Two copper plates found in the Etowah Mound in Georgia present inscribed figures of winged bird—masqued dancers one of whom carries a rattle in his hand, and the headdress of both may symbolize the rattle of the snake. Other figures of dancers have been found in mounds of Union County, Illinois.[29] So that Mound Builders evidently used the rattle in ceremonial dances, which may have been performed within the square.

Granting that our deductions have been correct so far, the Works as a whole represent the figure of a winged or plumed rattlesnake with the sun at its head towards the east, the moon and stars at its center, towards the north, and its tail towards the west.

This design indicates on its face that the serpent represents the ecliptic or course of the sun, moon, and planets across the sky. But since the sun is placed at the eastern end of the serpent, and we cannot suppose that the serpent would be depicted moving backward, the sun is here moving from west to east or eastward among the stars of the zodiac. This does not necessarily imply that the Mound Builders had discovered for themselves that by day the sun is moving among the stars obscured by his light, though such a deduction was probably not beyond the power of any people who watched the apparent continuous westward motion of the stars, and who valued this knowledge of the celestial world so highly that they constructed the gigantic Works to record it. To the modern Indians the celestial world is the perfect, yet ever present home of the Great Spirit and of their living dead. They may have

[28] 1875, p. 7.
[29] Shetrone, 1930, p. 133, fig. 74. Fowke, 1902, pp. 723, 724.

inherited the religious idea of the more advanced Mound Builders with whom their ancestors were in contact. This, indeed supplies an adequate motive for the tremendous labor lavished on the Works which reflected the celestial design. But since these astronomical discoveries had certainly been made by the Maya and probably by the Mexicans, the Mound Builders may have acquired the knowledge from them directly or indirectly when they acquired the symbols of the shell gorgets and the copper sheets of Etowah. As for the apparent motions of the moon and planets, the Mound Builders were quite capable of observing them.

The position of the Ohio River with respect to the Portsmouth serpent, which it crosses twice, suggests that the Mound Builders may have regarded it as the terrestrial analogue of the celestial river, the

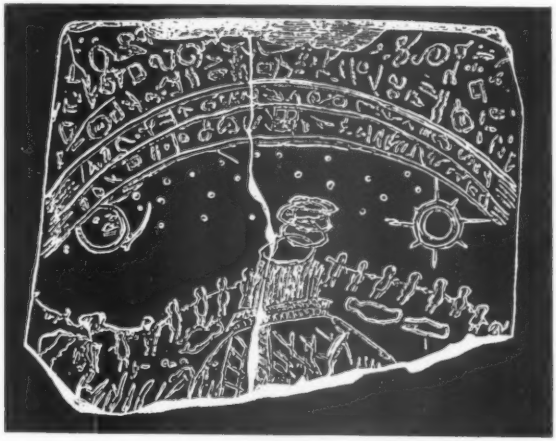

FIG. 8. TABLET FROM THE MOUNDS NEAR DAVENPORT, IOWA.

Milky Way, which follows a similar course with respect to the ecliptic and crosses it twice. For, though the Milky Way was the celestial path of the northern Indians, it appears as a river in a number of the Mexican codices. In the Borgian and in Vaticanus 3773 sheet 57, it is drawn as a stream between symbols of our Scorpio and Sagittarius, constellations that mark its passage across the ecliptic. It is true that to represent the relative position of the Milky Way accurately, the Ohio River should be north of the serpent, but the topography of the site obviously prevented that.

In 1877 an inscribed tablet of coal slate was exhumed about five and one-half feet below the surface of a mound near Davenport, Iowa[20] (Fig. 8). Despite the unquestioned good faith of the excavators and evidence of the antiquity of the tablet, doubt arose about it because the

[20] Proceedings Davenport Acad. of Sc., Vol. II, pp. 92-96.

inscription on both sides of it, and on another tablet found near by, were unlike any other objects found within the mound area or in any other part of America. They seemed to include hieroglyphs of ancient Oriental languages.

On the inscription with which we are concerned a fire is burning upon or within a mound before which human figures dance in front of three or four prostrate bodies or corpses. The sun, moon, and stars appear above them under a band which curves across the sky and is divided by a central line. Glyph-like figures cover this band and the whole of the tablet above it. On the other side of the tablet there is a group of animals, trees, and bushes including a large animal, possibly a Mexican tapir, and two lance like figures with more glyphs.

The Dakota Indians when shown drawings of these inscriptions, interpreted them as Indian drawings representing a dance within an earth lodge surrounded by a circular fence, the dancers being depicted outside the lodge because of lack of space in which to draw them within it.[31]

The Dakotas are a thousand miles or more distant from the Mounds area. But the recognition of the inscriptions as Indian is interesting though the interpretation is unconvincing. Let us note that the sun is represented with concentric circles and the crosses of the cardinal and diagonal points, the moon with crescent outline though containing a full face, and the stars by small circles. All these elements correspond with the Portsmouth symbolism but differ from our representations of these celestial objects. And the circular "fence" surmounting the sun, moon, and stars has the form and position of the Portsmouth serpent. These facts at least demonstrate that the artist who inscribed the tablet possessed an unusual knowledge of Indian symbolism. If the "fence" does represent the celestial serpent his knowledge would be extraordinary indeed for anyone other than a Mound Builder, or one conversant with the celestial symbolism of the southern cultures.

The so-called "glyphs" may be random scratches made for decorative purposes or to fill up blank spaces and only accidentally suggesting Oriental characters.

The lower half of the inscription may represent a dance in honor of the dead, such as the Hurons hold. The Mound Builders frequently seem to have buried their dead temporarily, then to have disinterred their bodies for cremation or permanent burial in large groups. This burial was accompanied by appropriate ceremonies held in a chamber within the burial mound, and in association with the sacred fire.[32] The practice of reburial was continued by tribes of the Mississippi Valley into recent times.[33]

Two striking analogies of the design of the Works as a whole may

[31] See Mallery in Bur. Am. Ath.
[32] Shetrone, 1930, pp. 87-89, 96, 97.
[33] LaHontan quoted in Proceedings of Davenport Academy of Sc., Vol. II.

be seen in the Mexican codices. On the right side of sheet 19 of the Codex Nuttall a procession issues from a temple surrounded by stars and having on its right the sun and its circles, and on its left the crescent moon enclosing a horseshoe. The procession passes over a path with sinuous curves ending in the sharp curve of a serpent's tail.

On the first two sheets of the Selden Codex a serpentine path with

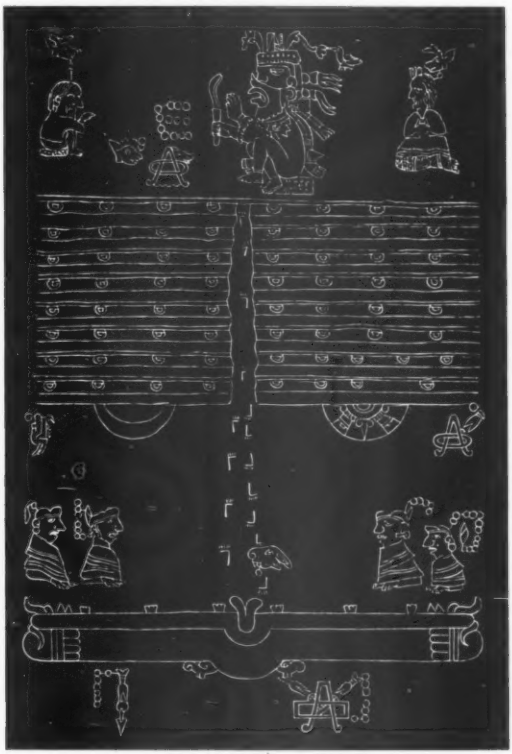

FIG. 9. THE MEXICAN HEAVENS,—SELDEN CODEX.

sinuous curves and tapering at the tail, issues from the eighth heaven where dwell the gods and descends through the middle of eight horizontal zones of stars to the lowest celestial zone where the sun and its circles are figured on the right and the crescent moon on the left (Fig. 9). Human footprints ascend upon this path. The earth is depicted on sheet 3 with four men seated upon it, apparently priests who study the heavens. On sheet 4 the serpentine path reappears issuing from the cave of night and continuing across the following sheets till it ends on

sheet 10. On the way it passes beside symbols of various zodiacal asterisms. Human footprints ascend and descend over it and on sheet 9 there is a procession, thus indicating to the Mexican priests a sinuous motion over the path formed by the body of the celestial serpent.[34]

So similarly at Portsmouth the design of the great temple of the heavens reflected on earth the design of the heavens, the curve of the serpent corresponding to the arch of the sky. From the circular mound within the head or, from the central mound now occupied by the former Children's Home, the astronomer priests probably watched the sun, moon, and planets as did their fellow priests in Mexico, for from those two mounds the entire design was visible. Thus they observed, and perhaps worshipped, the celestial deities from within the sacred structure dedicated to them.

The ritual procession of the Codex Nuttall, the footprints on the celestial path in the Selden and many other Mexican codices, as well as Maya symbols at Santa Rita, Chichen Itza and elsewhere, seem to establish the use of ritual processions in imitation of the passage of the sun, moon, and stars across the sky. Were there not similar processions at Portsmouth along the body of the celestial serpent? For such processions the walls that form the body of the serpent would not be used for concealment but only to mark the path to be followed. And the procession in following that path would imitate the motion of the heavenly bodies and journey like Votan in the Tzental myth through the body of a serpent to the dwelling of the thirteen serpents.

In view of the celestial symbolism expressed in the Works it may well be that some of the so-called signal mounds in their vicinity have been used to mark the sunrise or sunset points at the equinoxes and solstices, four points of conspicuous importance in the ritual of many tribes. The subject deserves investigation.

We have no clew to the date at which the Works were erected. They may be six centuries old or indefinitely older. But it is possible that some Indian traditions have preserved a memory of the Mound Builders and even of the builders of the Portsmouth Works.

The Leni-Lenape or Delawares assert in their Walum Olin, or painted and engraved traditions, that in the earliest recorded times their ancestors, in alliance with the Iroquois, fought with a people called the Snakes who dwelt on a great and fine island in the Ohio River and raised crops of corn. They also lived in stationary villages and towns along the Ohio. Brinton thought they were the Mound Builders and that their name may have been associated with the serpent mound of Adams County, Ohio. An independent Iroquois tradition related by Cusick also refers to an early war between the northern tribes and the Snakes who dwelt south of the Great Lakes and cultivated potatoes and beans. They were ruled by a great emperor who resided in a golden

[34] In Kingsborough, 1831, Vol. I, pp. 1-9; See Squier, 1851.

city, the capital of a vast empire. They built many forts, but were finally overcome by the Iroquois and their allies. Fowke thinks that the Golden City was a town of abundant polished copper located at one of the enclosures in the Scioto valley and ruled by a chief or sachem.[35] He was perhaps the leader of a confederacy like that of the Iroquois. In that case it is probable that the Snakes who dwelt near or on the Ohio and Scioto Rivers were Mound Builders whose capital was around the much greater serpent of the Portsmouth Works from which they derived their name.

In Scotland there is a serpentine embankment at Loch Nell, and in England serpentine avenues of erect stones at Mervale on Morton and Stanton Drew, where the body of a serpent passes through a central circle and terminates in smaller circles at its head and tail.[36] But the

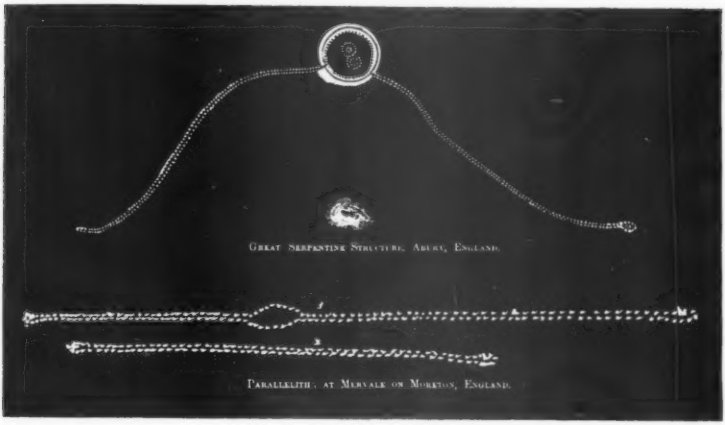

Fig. 10. Plan of the Temple at Abury, England.

remains at Abury or Avebury have greater interest for us (Fig. 10). There an avenue of standing stones curved in an irregular semicircle, suggesting the sky and representing a serpent, extended from an oval head on the Hakpen or Serpent Head hill on the east, northwesterly about a mile to a circular embankment 1400 feet in diameter and enclosing about 35 acres. It had an inner and outer ditch which may be regarded as two concentric circles, with four entrances approximately at right angles to each other. Within the circle there were originally two smaller double circles each composed of two concentric circles marked by erect stones. The serpentine avenue continued thence towards the southwest another mile to the point of the tail. The whole structure

[35] Fowke, 1902, pp. 434, 436-7, 442-3. Squier, Algonquins, pp. 14-41. Brinton, 1885, pp. 165, 230, 231. Cusick in Beauchamp, 1892.
[36] Squier, 1851, p. 237. Deane, Vol. XXV, p. 198.

can be viewed from the Serpent Head hill which has borne that name from prehistoric times. Its axis runs directly east and west.[37]

The analogy with Portsmouth extends to the symbolism. According to the Rev. E. Duke, the Abury serpent represents the ecliptic over which the sun glides in the form of a serpent, and Stukeley asserts that the small circles within the great circle were temples of the sun and moon in which the thirty and twelve standing stones marked respectively the days of the month and the months of the year.[38]

Alone of all known serpentine temples, that of Carnac in Brittany excels Portsmouth in extent. "The serpentine character of this great work is now well established. It consists of seven parallel rows of huge

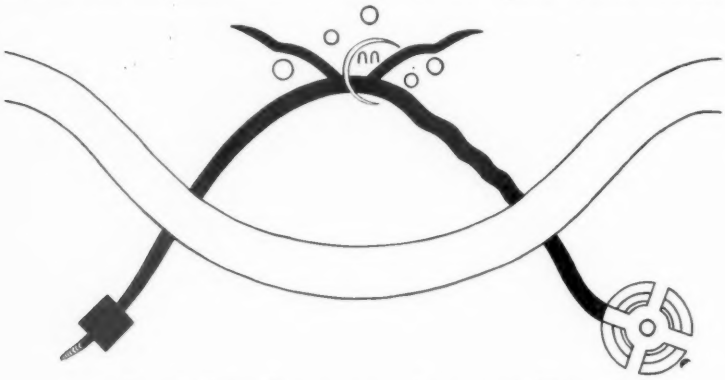

FIG. 11. IDEAL DESIGN OF THE PORTSMOUTH WORKS.

upright stones, which, following the sinuous course of the structure, can yet be traced for upwards of eleven miles, and it is believed that it was formerly thirteen miles in length. The line of this vast parallelithon is designedly crooked or serpentine, although maintaining a general direction from east to west; and the height of the stones is so graduated as to convey the idea of undulation, thereby rendering the resemblance to a vast serpent more complete and obvious. In connection with this structure is an eminence, partly natural and in part artificial, the well known Mount St. Michael, from which a general view of the great serpentine temple is commanded.

The worship to which this rude but stupendous temple was appropriated in common with the others above mentioned, is generally believed to have been that of the sun, of which the serpent is the common or correlative symbol."[39]

But the existence of serpentine temples in the Old World as well as the New does not necessarily imply intercommunication between their

[37] Stukeley, 1743, Table VIII. Squier, 1851, p. 234.
[38] Stukeley, 1743, pp. 43 and 44.
[39] Squier, 1851, p. 238.

builders. However there are analogies between the constellations of the Old and New World, especially those of the zodiac, which are difficult to explain as of independent origin, so we may rightly hesitate to dogmatize on this subject until our knowledge of it is more complete.

Our conclusions are that the Portsmouth Works were a temple for observation and worship of the heavenly bodies, the capital of heaven worship among the Mound Builders. They represented the sun, moon, and planets moving over the ecliptic which curves over the arch of the sky (Fig. 11). With the exception of Carnac only they constituted the most extensive known serpentine temple, and they were the most important archaeological remains in the United States. It is indeed unfortunate that their importance was not recognized before ignorance destroyed them almost completely, but their memory at least survives and we may hope that the parts of this great temple that remain will be permanently preserved.

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The Size of Meteors. The Leonids of 1932

By WILLIAM H. PICKERING

Only four determinations of the size of meteors dependent on the principle of the conservation of energy as far as I know have ever been made. The first was by Harkness, *American Journal of Science*, II, 1867, **45**, 237, the second by the writer in POPULAR ASTRONOMY, 1919, **27**, 365, the third by Öpik, *Publications of the Observatory of Tartu*, (Dorpat), 1922, **25**, No. 1, and the last by Lindemann and Dobson, *Proceedings Royal Society of London*, 1923, **411**, 102. Since my library here is small, all of these data except for my own measures are taken from Olivier's book "Meteors," pages 138 to 142. Harkness made three determinations, dependent on comparisons with a gas flame, with a lime

TABLE I.

COMPUTED VALUES OF THE SIZE OF METEORS.

Computers	Magn.	Vel.	Mass mgm	+3 mgm	−2 gm	−7 kgm	+3 mm	−2 mm	−7 mm
Harkness Lime light	1	..	60.0	4.0	4.0	4.0	1.02	10.2	102
Harkness Arc light	1	..	4.5	0.3	0.3	0.3	0.43	4.3	43
Öpik α Persei	2	56	1.0	0.5	0.5	0.5	0.51	5.1	51
Lindemann, Dobson	1	40	6.0	0.4	0.4	0.4	0.47	4.7	47

light, and with the carbons of an electric arc. The first we need not consider here since the color of the flame is so different. The effect of the difference in color of the lime and the arc lights is very striking, reducing the computed mass of the meteor 13 times (see Table I). In my determination I adopted the color of the incandescent carbon filament as a standard, believing that it was of about the temperature of melted iron, and that the liquid being blown away as fast as formed would keep the meteor at a constant temperature. This we now know was a mistake, and my measures are therefore rejected. The color employed

by Öpik is that of α Persei, a star of type F5, and of a color resembling that of the Sun. There is no statement of the color employed by Lindemann and Dobson, but since their results resemble those of Öpik we may assume that the color was similar. As to the speed with which the meteors were supposed to travel, no statement is made in the work of Harkness. Öpik selected a speed of 56 kilometers a second, and the other observers used a speed of 40 kilometers. The speed of the Leonids is 70, which would make their masses about one-third of those recorded here. In Table I the second, third, and fourth columns give the data furnished by the computers themselves; the next three, the masses corresponding to three different magnitudes, +3, —2, and —7, a speed of 40 kilometers being assumed for each series. The last three columns give the corresponding diameters. Omitting the comparison with the lime light by Harkness, the mean of the three remaining masses for a meteor of magnitude 3 is 0.4 milligrams, and its diameter 0.35 millimeters, or for a Leonid approximately 1/100 of an inch. Lindemann and Dobson compute that a first magnitude meteor, which would measure one millimeter in diameter gives out energy in flight at the rate of 4400 horse power per second. These results appear almost unbelievable, but let us now consider the case of the telescopic meteors.

Olivier states that he has observed many, which appeared like those seen with the naked eye, and some of which were only of the 15th magnitude. A meteor of magnitude 15 has a diameter of 1/250 that of a meteor of magnitude 3, or in the case of a Leonid a diameter of 1/25,000 of an inch. Now it is hard for me to believe that such a meteor would be visible in white hot condition through any appreciable interval of time at all, even in a perfect vacuum. Again, a meteor of magnitude —2 would have a mean diameter, as seen by Table I, of 4.7 mm. or rather less than 1/5 of an inch. Such a meteor would have a brightness equal to Jupiter. It might readily leave a trail lasting several seconds, or perhaps several minutes. Such a trail can be carefully studied, and, it is found, may exceed 10 miles in length by over a mile in diameter, let us say 10 cubic miles of space. Now I do not believe that a body of that computed size could instantly fill a space of those dimensions with light, either electrically, or by any other method. I have a very high respect for mathematical deductions,—in some cases, but I also have an even greater respect for common sense. I should find it difficult enough to believe that a 6-inch cannon ball could produce such a result, but on the other hand I do not believe that a meteor of the brightness, magnitude —2, could be much larger than that, for some of these very bright meteors, said during brilliant Leonid showers to equal the Moon, would otherwise have reached the surface of the Earth, and no such event during a Leonid shower has ever been satisfactorily chronicled. We can hardly imagine that a cubic foot of iron could be completely vaporized in a second or two by heat supplied only on the advancing side.

When an unbelievable conclusion is reached mathematically, it is usually the result either of the application of an inappropriate mathematical method to the investigation, to the neglect of important facts, or to erroneous assumptions. All of these investigators seem to have assumed that it was the meteor itself that gave out the light,—a very natural and plausible supposition. Fortunately three photographs of meteoric spectra have been secured, all of course by accident. One was taken at Harvard and two at Moscow. Each shows a strong gaseous spectrum, while the continuous spectrum is either extremely faint or wholly lacking. It therefore appears that practically all the light comes from the incandescent gases given off by the meteor, and surrounding its front with a luminous atmosphere. The temperature of the meteor itself does not rise above its boiling point at that low pressure, and it is therefore only the atmosphere whose brightness and mass we are measuring. What we really wish to know in order to obtain the mass and size of the meteor is the *rate* at which its solid contents are melted, boiled, and blown away, the time it takes to cool down, and also what is the efficiency of the luminous atmosphere as a source of light. The only facts that we have to furnish us with all this information are the brightness of the meteor and the velocity with which it is approaching the Earth. These are obviously insufficient. *This therefore eliminates at once, as of no value, any determination that we may make of the mass of the meteor based upon the principle of the conservation of energy.*

The only direct measurement hitherto made, as far as I am aware, of the size of the atmosphere of a meteor was based on the brightness of the carbons of an electric arc, *Harvard Annals*, **41**, 141, and *The Astrophysical Journal*, 1909, **29**, 365, and 1910, **31**, 89. In *The Astrophysical Journal*, 1909, **30**, 318, Professor Fabry applied the method to determine the size of the meteor itself. My results were that the diameter of the atmosphere of a meteor of magnitude 3 was 5 or 6 centimeters, and that the diameter of the meteor itself was 7 millimeters. The result obtained by Professor Fabry for the latter was 5.42 millimeters. For the reasons above stated, since we have no adequate means of measuring the size of a meteor, I do not place any confidence in the last two results, although I believe them not unlikely to be fairly correct, and much more probable than those contained in Table I. Regarding the shape of the atmosphere of a meteor we of course have no knowledge beyond that it forms a circular convex zone in front of the meteor, but our method of attack was at least logical, and probably gives some idea of the truth. None of the spectra show any evidence of iron lines which to say the least is peculiar, and would doubtless give us some valuable information if we could explain the fact. It is my estimate and belief that if we assign to a meteor of magnitude —2 a diameter between 5 and 15 cm, or 2 and 6 inches, we shall be not far out of the way, and further that the method above described, by considering what is not probable is at present the only practicable one.

THE LEONIDS IN 1932.

It is not yet sufficiently widely recognized that the period of the Leonids is not constant, but like that of the comets is constantly varying. The average period since they were first observed in 902 is 33.3 years, and that or 33.25 is the period usually given for them at the present day. Sometimes it is stated to be 33 years. The second observed appearance was in 931 after 29 years. Another appearance in 934 was after 32 years. After 1602 the next recorded appearance was in 1698, interval 96 years for three revolutions. The next appearance in 1799 involves one period of 33 and two of 34 years. This last appearance was a really great shower and, like those that followed it, was observed in America. The greatest of all recorded showers came in 1833. The next in America was in 1867, but was seen and very fully described in England the previous year. The next was seen in the West Indies, Mexico, and Arizona in 1901 as predicted by the writer (POPULAR ASTRONOMY, 1899, **7**, 523). In all these recent cases it will be noted that the period was exactly 34 years. Unless, therefore, the period has changed again since then, we can hardly expect the maximum shower to appear in America before 1935, but it may appear in central Europe and Egypt a year earlier. However, these last two or three years the shower has appeared fairly well marked, and has been well worth observing. An effort was made here to get some observations in 1931, but clouds interfered too seriously for me to get anything worth publishing. During this last shower I have been somewhat more successful.

First, however, I will make a few suggestions based in part on the observations made thirty to thirty-five years ago. A new generation has arisen since then, and it is hoped that these suggestions may be of some use to those who will make most of the observations of the next few years. There is no question but that a meteor shower consists of one or several very rarefied comet-like objects whose component particles are usually no more than a few millimeters or centimeters in diameter. We should never see them at all, or know of their existence, did they not become luminous by entering our atmosphere. They differ in one respect, however, from ordinary comets, in that they have no massive nucleus, and no very large metallic masses associated with them. They are therefore incapable of reaching the Earth, or of doing us any harm. These cometary bodies or clusters are sometimes probably only a few hundred miles in diameter, although sometimes they are much larger. Their boundaries are sometimes quite sharp. Thus in 1901 there was no meteoric shower that amounted to much in the Northern States, but in the northern West Indies, in Mexico, and in Arizona the shower was very fine, the meteors coming at the rate of four or five a minute, with many bright ones. Thus the same meteor shower may appear very differently to different observers watching it at the same time from different places. This was perhaps the first time that we were able to detect the northern or southern edge of a shower. Since I may perhaps be

the most southern of the northern observers of the Leonids during the next few years, although there may be some very much farther south, I feel it important to get all the observations I can. Now, as to the longitude, suppose that an observer in England sees the shower to the best advantage in a certain year at 4^h G.C.T. The next year the Earth will not reach that point until 6 hours later, since our year is 365 days and 6 hours. Therefore a man in Chicago will see the shower in that year to better advantage at 4^h C.S.T. This very thing happened in 1866 and 1867, when the shower was seen best in England in the former year, and best in America in the latter. Now we should not compare the observations of the English observer with one another in those two years, but should compare those that he made in the former year with those made by an American observer in the latter. Again a very splendid shower appeared in Arabia in 1832 followed by the great American shower of 1833. For this same reason observers in Hawaii in longitude 160° W, and in India are particularly needed to complete the circuit of our globe. It is hardly necessary to point out the importance also of Japanese observations. Owing to the advance in longitude of the node, the theoretical difference in longitude of the stations should be 6.8 hours.

Another point to be noticed is that all observers are not alike, even if apparently equally interested in their work. Over thirty years ago we had a number of astronomers and a considerable number of Harvard students stationed at the observatory counting Leonids. On the whole the astronomers did better than the students, but there were great differences in both classes. Of two men looking at the same time at the same part of the sky, one might see 50 per cent more meteors than the other. Again, and this is very important, in the case of a group of observers each man should keep his own count entirely distinct from that of the others. Two observers will naturally see more meteors in the same area than one, but they will not see twice as many. The ratio in this case depends on the characteristics of the observers themselves, and therefore cannot be corrected or computed. The two men are simply wasting their time, instead of getting results of real value. This is not a competition to determine which man, or group, or which observatory will see the most meteors. What is wanted is to learn how many meteors the average man in that particular longitude and latitude can see. Had we enough observers properly distributed, an isometeoric map might prove very instructive as well as interesting. Some men may want to work on the count, others on the location of the radiant, and still others on other matters, such as the dimensions and drifting of the trails of very bright meteors, but each man should stick to his job for as many nights as he observes, and not change about.

A reclining steamer chair makes the best possible seat, especially when the radiant approaches the zenith and the meteors are coming most frequently. A kerosene lamp in a wooden box makes an excellent light for those to whom electricity is not readily available. A 4x6 paper

pad is perhaps the best means of record. All important observations should be made in the direction of the radiant, although the long streaks in other portions of the sky are very pretty to watch, for those disinclined to do serious work. The maximum area of the sky which a man can thoroughly cover does not exceed 45° horizontally by 35° to 40° vertically. One cannot go as far above as below the radiant, so I try to cover a circular area extending 20° above it by 25° below. The area described stretches practically from α Hydrae to λ and μ Ursae Majoris. On a clear dark night the faintest meteors surely seen may properly be classified as of the 5th magnitude. When there is a bright Moon in the vicinity, as was the case this past year, I call the faintest meteors recorded as of magnitude 4. Very bright meteors may be described in terms of Sirius, Jupiter, and Venus. Two-thirds of the Leonids recorded this last November were brighter than the third magnitude, previous years the great majority were fainter, thus clearly indicating the blanketing effect of moonlight on these fainter bodies. For purposes of comparison we may say that μ Leonis is of the 4th magnitude, η Leonis of the 3.5, ϵ Leonis of the 3d, γ of the 2d, and α of the 1st, or more accurately speaking 1.4. Arcturus and Capella are of 0 magnitude. Sirius may be taken as —1.4, Jupiter as —2, and Venus as —4. Of course, if a meteor stood still its brightness would be greater than if it trailed, how much brighter we cannot say, but that is not important. The stars merely give us the means to compare the brightness of one meteor with another, and that is what we most need. When the meteors do not occur very frequently, as was the case this year, the time of each should be recorded, also the magnitude, whether its luminous trail reaches back into the especially observed area, and whether it was a Leonid or not. The moment that clouds partially cover or leave this area should of course be immediately recorded. Should the meteors come very fast, the observer's attention should be confined to a smaller area, marked out by three or four conspicuous stars. The area included between ϵ Hydrae, α Hydrae, δ Leonis, and 40 Lyncis is recommended. This area may easily be enlarged, but should be of such a size that not more than ten per cent of the observer's time need be occupied in recording. It would be better still in such a case if each observer were provided with a recorder. A detailed description of the magnitudes, and number of meteors per square degree observed in such an area, in the case of a truly great shower would be a new and interesting fact in astronomical literature.

I turn now to my own observations. A very interesting paper by Professor Wylie in POPULAR ASTRONOMY, 1931, **39**, makes the statement on page 611 that the mornings of November 16 and 17 would be the best dates to observe the Leonids. These were the dates, therefore, that I selected for my own observations. I intended also to observe on the 18th should the previous night's observations be favorable. Such, however, did not prove to be the case, and I then regretted that I had

not begun a day earlier, especially as the night was fine when I retired. On November 16 at $3^h\,03^m$, E.S.T., I began observing. Between $3^h\,15^m$ and $3^h\,45^m$ I saw 6 Leonids, none beginning outside of the selected area. Between $3^h\,45^m$ and $4^h\,15^m$, 7 were seen, 2 being outside of it; between $4^h\,45^m$ and $5^h\,15^m$, 5 were visible, 2 again being outside of it. During the 20 minute period between $5^h\,15^m$ and $5^h\,35^m$, 5 were seen, 3 outside of the selected region. Of the 23 Leonids seen in 1 hour and 50 minutes 7 were outside of the region. This probably implies that I could not fully cover a circle of even 45° in diameter. It must be remembered, however, that the meteors are more crowded near the radiant. Two non-Leonids also were recorded, 8 per cent of the whole number. There were, therefore, 16 Leonids in the selected region, coming at the rate of 8.7 per hour, or one every 7 minutes. The selected area contains 1600 square degrees. The meteors, therefore, were coming at the rate of 5.5 per 1000 square degrees per hour. On account of the moonlight none of them were fainter than the 4th magnitude, and doubtless many of these were missed. It is pretty clear, however, that Leonids of the 2d magnitude and brighter, that is those that we may call bright meteors, are not likely to be missed whatever the age of the Moon, unless indeed it is located almost in the radiant itself. Therefore in future, in years in which there is a bright Moon, we need not be discouraged from observing, in case we are willing to confine our attention to the bright meteors alone. The reason for this is that the radiant of the shower is in longitude 148°, while the Sun on November 16 is in longitude 233°, or 83° distant. Therefore it is not the full moon as is nearly always stated that interferes with the observations of these meteors, but the Moon in the last quarter. The full Moon is practically always about 90° distant, is rather low in the sky, and gives us little trouble. When my observations were made, the longitude of the Moon was 86°, in $\alpha\ 5^h\,47^m$.

Dealing now with these bright and very bright Leonids exclusively, since useful observations of those of the medium magnitudes, 3 and 4, and of the fainter ones 5, were ruled out, we find that 11 were seen in the selected region of 1600 square degrees, or 0.375 meteors per hour in 100 square degrees. If these meteors first became luminous at a height of 100 miles, then they would first become visible over an area of 311 square miles. A cross section of the Earth is 50,000,000 square miles, and if the meteors were uniformly distributed over it at the rate observed, we should intercept 61,000 bright meteors every hour. The relative velocity of the Earth and these meteors is 44 miles per second, or 160,000 miles per hour. To fill a cylinder of this length and cross section with 61,000 meteors implies that the meteors average 510 miles apart, they may be estimated at about an inch in diameter, and each meteor has reserved to it 133,000,000 cubic miles of space. Between them there is also a certain number of smaller meteors, and a considerable amount of meteoric dust.

Including all the Leonids seen, two were very bright, one at $3^h\ 19^m$ was half-way in brightness between Sirius and Jupiter, and one at $5^h\ 25^m$ was equal to Jupiter. Of the bright meteors ranging all the way between magnitudes —0.5 and +2.5, 14 were seen, and there were 7 fainter ones. The Leonids outside plus those inside make the totals. Full details of the observations are given in Table II, which I believe needs no further explanation. The next night was cloudy until $4^h\ 30^m$. Observations were begun at $5^h\ 00^m$ through a light haze, which did not, however, conceal 4th magnitude stars in the vicinity of the radiant. Four meteors were seen in the next 15 minutes, 3 of which were Leonids in

TABLE II.

LEONIDS IN 1932.

E.S.T.	Outside Non.		Very Bright Leonids		Medium Bright		Very Inside		Medium Bright	
From $3^h\ 15^m$ to $3^h\ 45^m$	0	0	6	1	3	2	6	1	3	2
From $3^h\ 45^m$ to $4^h\ 15^m$	1	2	7	0	4	3	5	0	3	2
From $4^h\ 45^m$ to $5^h\ 15^m$	0	2	5	0	4	1	3	0	3	0
From $5^h\ 15^m$ to $5^h\ 35^m$	1	3	5	1	3	1	2	0	1	1
	2	7	23	2	14	7	16	1	10	5

the selected region. Two of these were bright, but no more were seen before $5^h\ 30^m$ when the observations were closed on account of dawn. A display of 6 Leonids an hour was not considered sufficiently encouraging to make it worth while to continue the observations on the following night, although the evening was clear.

PRIVATE OBSERVATORY, MANDEVILLE, JAMAICA, B.W.I., DECEMBER 5, 1932.

Planetary Phenomena in 1933

By HERBERT C. WILSON

ECLIPSES.

This year will have the smallest possible number of eclipses, both of these being of the sun, and both being annular eclipses, i.e. the tip of the moon's shadow falls short of the earth's surface as it passes by, and the observer who may be in line with the axis of the shadow may for a moment see a perfect ring (*annulus*) of sunlight surrounding the black disc of the moon.

The following data concerning the two eclipses are taken from the *American Ephemeris and Nautical Almanac* for the year 1933:

I. AN ANNULAR ECLIPSE OF THE SUN, FEBRUARY 24, 1933.

This will be invisible in the United States. The path of annular eclipse begins off the coast of Chile, crosses Chile and Argentina, the Atlantic Ocean, and Central Africa, ending in the Indian Ocean just south of the coast of Arabia. The partial eclipse phases may be seen in the southern half of South America, the South Atlantic Ocean, and the greater part of Africa. Points marked in the path of annular eclipse on the *Ephemeris* chart are: Valdivia, Chile; Stephanieville, Belgian Congo; and Aden, Arabia.

Circumstances of the Eclipse:

	G.C.T. d h m	Longitude from Greenwich ° ′	Latitude ° ′
Eclipse begins	Feb. 24 09 55.8	+62 21	—34 56
Central eclipse begins	24 10 58.3	+79 09	—39 35
Central eclipse at local apparent noon	24 12 33.7	+ 5 05	—23 56
Central eclipse ends	24 14 34.3	—52 18	+14 28
Eclipse ends	24 15 36.8	—35 51	+19 00

II. An Annular Eclipse of the Sun, August 21, 1933.

This will be invisible in the Western Hemisphere. The path of annual eclipse will cross the northern edge of Egypt, Arabia, Persia, India, Siam, Borneo, and the northern part of Australia. Points within or close to this path, marked on the *Ephemeris* chart, are: Alexandria, Egypt; Jerusalem, Palestine; Bagdad, Iraq; Delhi, India; and Calcutta, India. The partial phases of the eclipse may be seen principally in Asia, Australia, and the Islands north of Australia.

Circumstances of the Eclipse:

	G.C.T. d h m	Longitude from Greenwich ° ′	Latitude ° ′
Eclipse begins	Aug. 21 02 52.1	— 41 00	+28 26
Central eclipse begins	21 03 55.5	— 24 38	+30 11
Central eclipse at local apparent noon	21 05 44.0	— 94 48	+17 55
Central eclipse ends	21 07 42.0	—150 38	—20 31
Eclipse ends	21 08 45.3	—134 21	—22 16

The Planets.

The apparent movements of the planets along the ecliptic during the year are shown on the charts in Figures 1, 2, 3, and 4, which have been prepared with the aid of the constellation charts, SCL, furnished through the courtesy of the Eastern Science Supply Company. On these star charts the courses of the planets have been plotted from the data given in the *American Ephemeris*.

Mercury.

The apparent course of Mercury is shown by the smooth black line in Figures 1 and 2. It begins the year about ten degrees northeast of the first magnitude star Antares in the constellation Scorpio, moves eastward, crossing to the south side of the ecliptic on January 8 and continuing on the south side until February 26. It will be hidden in the glare of the sun during this time, being at superior conjunction on February 8. During the first two weeks in March Mercury will be well out from the sun's glare in the evening, its greatest distance from the sun at that time being 18° 14′ east on the evening of March 6. On March 13 the planet will be stationary at the east end of the loop in its apparent path, then will move westward until April 4, when it will again be stationary, making the turn at the west end of the loop. In the meantime it will have passed between the earth and sun, inferior conjunction, on March 23. On April 20 Mercury will be at greatest distance west from the sun, 27° 25′, and will be in favorable position for morning observation during the two weeks about that time.

During May and June the planet will be hidden by the sun, passing superior conjunction on May 28. In July and the first part of August it will describe a closed loop in the constellation Cancer, being at greatest eastern elongation, 25° 53′, on July 2; at inferior conjunction, July 30; and at greatest western elongation, 18° 37′, August 18. During September and October the motion will be east-

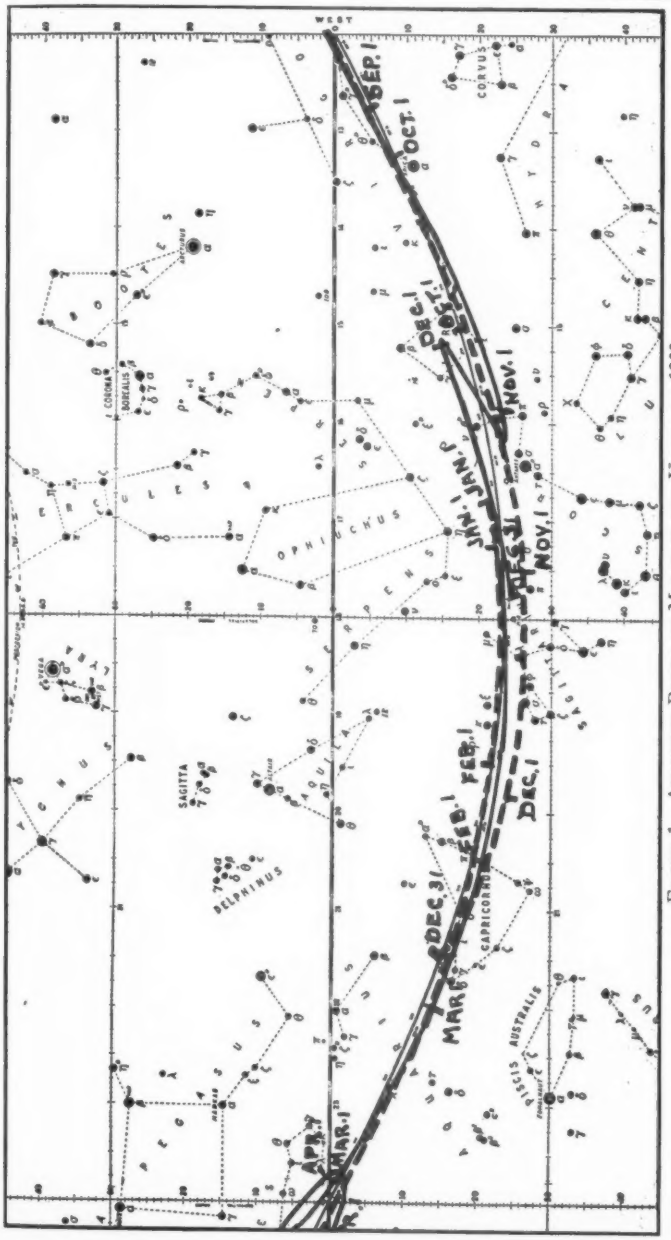


FIGURE 1. APPARENT PATHS OF MERCURY AND VENUS IN 1933.

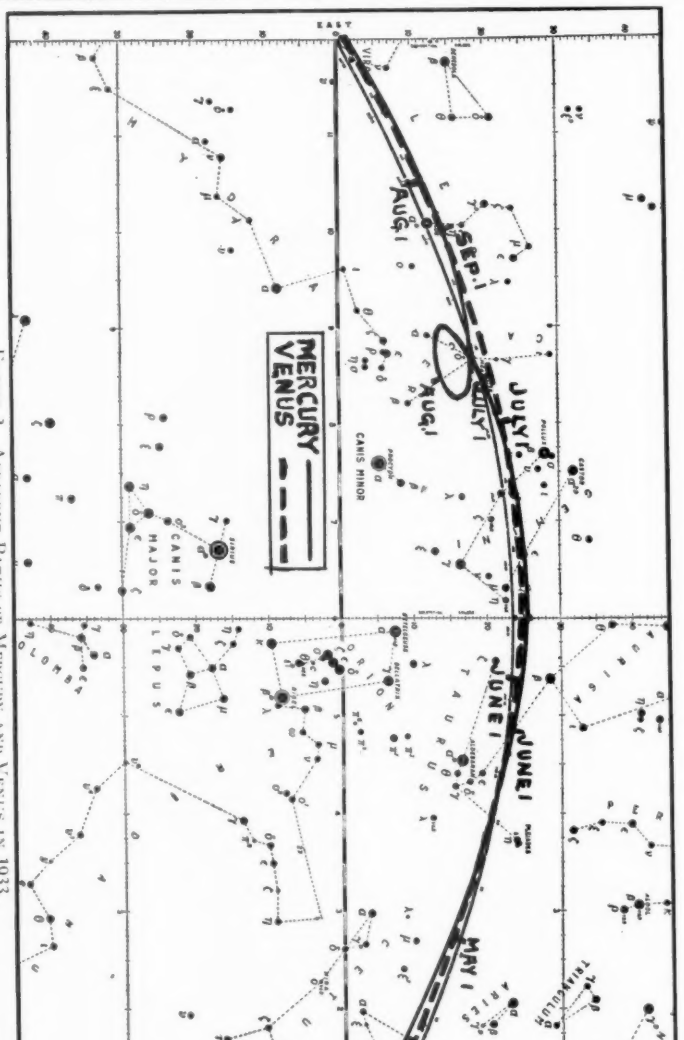


FIGURE 2. APPARENT PATHS OF MERCURY AND VENUS IN 1933.

ward along the descending slope of the ecliptic, with superior conjunction occurring September 12. The planet will be at greatest elongation, east from the sun 23° 57′, on October 28; at inferior conjunction November 19; and at greatest elongation west, 20° 41′, December 6; describing in this time the reversed S-shaped loop in the constellations Scorpio and Libra. Mercury finishes its wanderings for the year about 6° east and 2° south of the point where it started.

Venus.

The path of Venus for the year is shown by the line of heavy dashes in Figures 1 and 2. It begins about 6° west of Mercury's starting point and follows roughly the line of the ecliptic, eastward during the entire year. It crosses the ecliptic four times: southward January 26; northward May 19; southward September 8; and northward December 30. The planet will be at superior conjunction April 21 and so will be hidden by the solar rays during most of the spring months. It is "morning star" now but will be "evening star" after April 21, becoming visible to the eye soon after sunset in June and growing brighter rapidly as it emerges from the strong twilight in the later months. Venus will reach its greatest elongation, east from the sun 47° 17′, November 25. At that time its phase will be half full, like the half moon. Its maximum brilliancy will be attained on December 31, when its stellar magnitude will be —4.4, or thirteen times as bright as Sirius. The phase then will be crescent.

There will be two occultations of Venus by the moon this year, but neither will be observable in the United States. The first will be on November 21, conjunction in Right Ascension occurring at $1^h\ 19^m$ A.M., Greenwich Civil Time, when Venus and the moon will be $10^h\ 09^m$ west of the Greenwich meridian and 25° 40′ south of the equator, or nearly overhead at the Society Islands in the Pacific Ocean. This might be seen from New Zealand and the eastern part of Australia, by daylight observing with a telescope, or with field glasses.

The second occultation of Venus will happen on December 20, conjunction in Right Ascension occurring at $7^h\ 04^m$, Greenwich Civil Time, when Venus and the moon will be overhead at the northwest coast of Australia. This may be seen by daylight observing in the Islands of the Netherland East Indies, as well as in Japan and parts of China and India. On the Pacific Ocean the sight will be an interesting one to those traveling on ships in the evening. Since the disc of Venus has a perceptible area, the disappearance of Venus behind the body of the Moon will not be instantaneous as is the occultation of a star, but the light of the planet will fade gradually for several seconds, while its reappearance will not be caught immediately because of its faintness and the light will increase gradually.

Mars.

The course of Mars, shown in Figure 3, begins the year in the constellation Leo. The motion is retrograde from January 22 to April 13, then direct for the remainder of the year, ending at the west edge of Capricorn. On March 1, at the middle of the great loop formed in Leo, the planet will be opposite to the sun from the earth, but north of the straight line from sun through earth because of the tilt of the orbit of Mars with reference to the plane of the ecliptic. Mars will be within three degrees of the star Regulus during the most of April, while it is making the turn at the western end of the loop. At opposition, March 1, the distance of Mars from the earth will be about 62,700,000 miles. The apparent diameter of its disk will then be 13″.86, and its stellar magnitude —1.0, nearly 9

times as bright as Regulus. The satellites of the planet, Phobos and Deimos, are too faint to be seen with a small telescope.

JUPITER.

The apparent course of Jupiter is shown in Figure 4. It begins the year in Leo about 6° southeast of Mars, makes a similar but shorter and narrower loop, between January 8 and May 10, then moves eastward, ending the year in Virgo about 4° north of the star Spica. Jupiter will be at opposition, at a distance of about 412,000,000 miles, on March 9. Jupiter and Mars will be in conjunction on June 4 at 10:00 P.M., Greenwich Civil Time, when the latter will be only 16′ below the former, so that the two planets may be seen in the same field of view with a small telescope. The winter and spring months will be quite favorable for study of the two planets together.

The four bright moons of Jupiter, with their ever varying positions and the ruddy belts with their changing detail, never fail to hold the interest of the amateur astronomer who has access to a good telescope.

Jupiter and Venus will be in conjunction August 17 at 11^h, G.C.T., when Venus will be only 6′ south of Jupiter. This conjunction may be seen by daylight observation in Europe, Africa, and part of Asia, and in the evening in India and part of China.

SATURN.

The path of Saturn is shown in Figure 3 and lies wholly in the constellation Capricorn. The motion of the planet is eastward until May 27, then westward until October 14, and eastward until the end of the year, when it will be close to the inconspicuous star θ. It will be at opposition to the sun August 5, so that the most favorable time for observing the planet with its famous rings and its retinue of satellites will be in the summer and autumn. Its low latitude will, however, be unfavorable for northern observers. The tilt of the plane of the rings to the line of sight from the earth is about 17° in August so that the rings will be well open to view.

There will be a conjunction of Saturn and Venus on February 14 at 9:00 P.M., G.M.T., when Venus will be only 12′ south of Saturn. Another conjunction of these two planets will occur on December 21 at 10:00 A.M., G.M.T., with Venus 20′ south of Saturn. This conjunction may be seen best in India, Siam, and the Islands south of the China Sea, although the planets will be near each other for several days, so that their near approach may be seen all over the inhabited world.

There will be nine occultations of Saturn by the Moon during the part of this year when Saturn is well out from the interference of the sun's rays. The dates of conjunction in right ascension are:

	G.C.T.			G.C.T.
	h m			h m
May 15	20 31		September 29	6 11
June 12	4 31		October 26	11 33
July 9	12 24		November 22	19 48
August 5	19 32		December 20	8 15
September 2	1 23			

None of these occultations is visible in the United States. In the cases of the first seven the moon's geocentric declination is from 25′ to 49′ south of that of the planet, so that it requires a large parallax from the south to project the moon upon the planet. The regions where these occultations will be visible are all in the southern hemisphere and mostly on the seas. For the last two however the

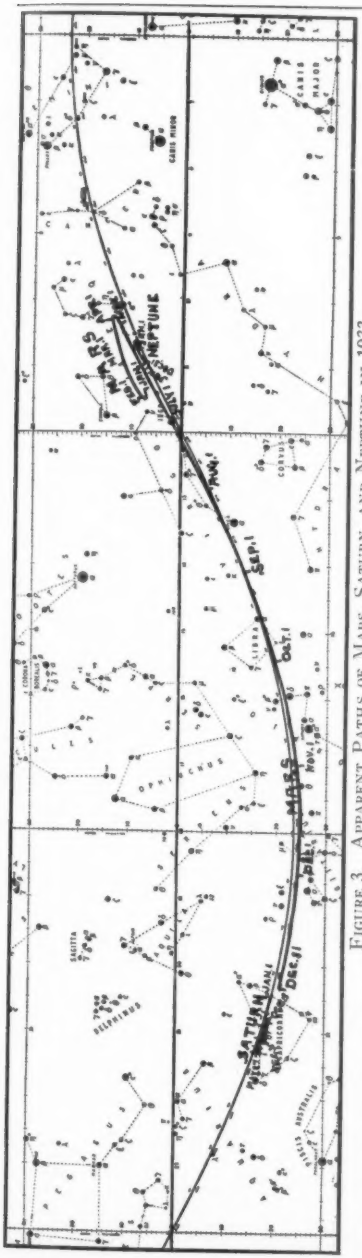


FIGURE 3. APPARENT PATHS OF MARS, SATURN, AND NEPTUNE IN 1933.

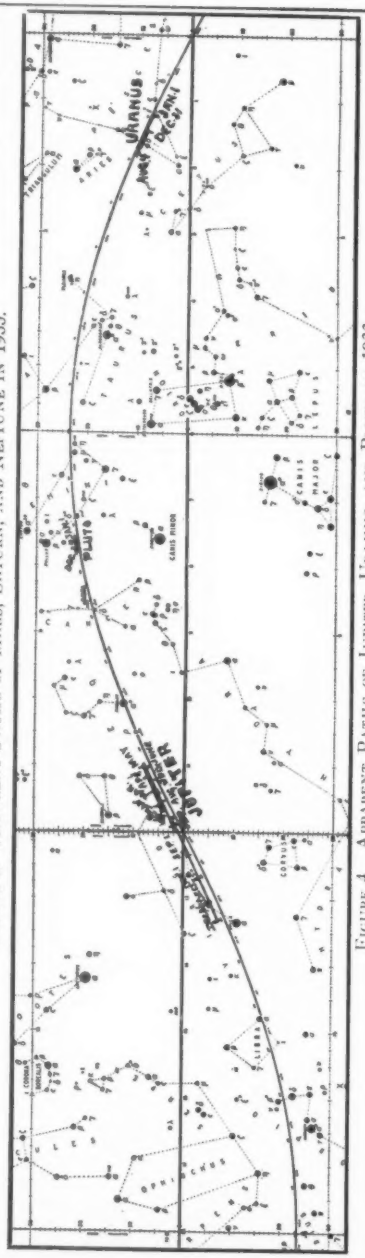


FIGURE 4. APPARENT PATHS OF JUPITER, URANUS, AND PLUTO IN 1933.

conditions are better. The one on November 22 will happen when the Moon is nearly overhead at Rio de Janeiro and so may be observed during daylight over the most of South America and in the evening along the west coast of Africa. The one on December 20 will occur when the moon is overhead at a point in the Indian Ocean about 700 miles south of Batavia and may be observed by daylight in India, Siam, parts of China, and the Islands of Netherland East Indies, and in the evening on many of the smaller islands in the Pacific Ocean.

URANUS.

The course of Uranus is eastward across the constellation Pisces until August 3, then westward until the end of the year. The planet will be at opposition to the sun, and so in best position for observation, on October 19, and may be readily seen with a good telescope during the three months before and after that time. On August 26 Uranus will be a little over 1° directly north of the 4.5 magnitude star o Piscium. It will be less than 3° from that star during the latter half of the year. The satellites of Uranus are too faint to be seen with small telescopes.

NEPTUNE.

The course of Neptune, shown in Figure 3, is short, in the constellation Leo underneath the big loop of the path of Mars. It begins the year about 4½ degrees east and one degree south of the 4th magnitude star ρ Leonis, moves westward until May 19, when it will be about 2° east of the star ρ, then moves eastward until December 15, and westward for the rest of the year. Neptune will be at opposition on February 27 and so may be observed, with large telescopes, during the winter and spring months. Occultations of Neptune are indicated for January 15, February 11, March 11, April 7, and May 4, but none will be visible except in far southern latitudes. Neptune will be in conjunction with Venus on August 3 at 19^h, G.C.T., Venus being then 38′ north of Neptune.

PLUTO.

The new planet Pluto, the greater part of whose orbit lies outside that of Neptune, follows a short course about 6° south of the first magnitude star Pollux and 2° south of the fourth magnitude star κ in the constellation Gemini. It moves westward about one degree, then eastward about three and three-fourths degrees, then westward about one degree, the net eastward movement during the year being roughly five times the apparent diameter of the moon. The planet is too faint to be seen with small telescopes.

Planet Notes for February, 1933

By CLIFFORD E. SMITH

The *Sun* will be moving northeast from the central part of Capricornus to the central part of Aquarius. At the beginning of the month its distances from the earth will be about 91.5 million miles, and, during the month, this distance will increase about 200,000 miles. On February 24 there will be an annular eclipse of the sun visible in the southern hemisphere. The position of the sun on the first and last days of the month will be, respectively: R.A. 20^h 57^m, Decl. —17° 17′; R.A. 22^h 42^m, Decl. —8° 13′.

The phenomena of the *Moon* will occur as follows:

First Quarter	Feb.	2 at	7 A.M.	C.S.T.
Full Moon		10 "	7 A.M.	"
Last Quarter		17 "	8 A.M.	"
New Moon		24 "	7 A.M.	"

Apogee	Feb. 3 at	3 P.M.	C.S.T.
Perigee	18 "	5 A.M.	"

Mercury will be near the sun in apparent position during the first part of the month since superior conjunction will occur on February 8. By the end of the month, however, it will set about an hour after the sun, and it will be in western Pisces. At the end of the month its distance from the earth will be about 100 million miles and its apparent diameter will be about six seconds of arc. Conjunction with the moon will occur on February 25 (Mercury 1½° S).

Venus will be near the sun in apparent position during this period in the morning sky. At the end of the month it will rise somewhat less than an hour before the sun. Its distance from the earth during this period will be about 150 million miles and its apparent diameter will be about 10 seconds of arc. On February 14 there will be a rather close conjunction of Venus with Saturn (Venus 12′ S), and on February 23 Venus will be in conjunction with the moon (Venus 38′ N). At the end of the month it will be in eastern Capricornus.

Mars will be in eastern Leo, and it will be above the horizon most of the night hours since opposition will occur on March 1. During the month its distance from the earth will decrease about 10 million miles so that at the end of the month its distance from the earth will be about 63 million miles, and, at that time, its apparent diameter will be about 14 seconds of arc. Conjunction with the moon will occur on February 12, and Mars will be at aphelion on February 16.

Jupiter, at the beginning of the month, will be only three or four degrees from Mars in Leo, and, like Mars, will be above the horizon most of the evening hours. Its distance from the earth during this period will be about 420 million miles, and its apparent diameter will be about 41 seconds of arc. Conjunction with the moon will occur on February 12 (Jupiter 3° N).

Saturn will be near the sun in apparent position, since conjunction with the sun will have occurred on January 27, and thus will not be of interest during this period.

Uranus will be in the evening sky in Pisces, and, during the middle of the month, it will set about four hours after the sun. Its distance from the earth during this period will be about 1.9 billion miles, and its apparent diameter will be about 3⅓ seconds of arc. Conjunction with the moon will occur on February 28 (Uranus 4½° S).

Neptune will be in Leo with Mars and Jupiter but about ten degrees northwest of Mars and Jupiter. Opposition with the sun will occur on February 27, and thus Neptune will be above the horizon practically all night long. Its distance from the earth will be about 2.7 billion miles, and its apparant diameter will be about 2½ seconds of arc. Conjunction with the moon will occur on February 11 (Neptune 1° N).

Variable Stars

Monthly Report of the American Association of Variable Star Observers for November, 1932

The accompanying report is the largest received for the month of November in recent years. Of the 3313 observations communicated, 37 per cent were made by thirteen foreign observers, illustrating the value of world wide coöperation.

Variable Star Observations Received During Novemreb, 1932.

Sept. 0 = J.D. 2426951; Oct. 0 = J.D. 2426981; Nov. 0 = J.D. 2427011.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

V Scl
000330
975 11.0 Bl
978 10.3 En

S Scl
001032
952 9.1 Ht
974 7.5 Ht
975 7.4 Bl
976 7.9 En
978 7.6 En
979 7.1 Ht
981 7.3 En

X And
001046
015 14.0 Bw

T Cet
001630
000 6.6 L
010 6.7 L

T And
001726
980 9.1 Jo
983 9.0 Jo
988 9.2 Jo
996 10.4 Me
002 10.8 Jo
002 10.5 El
002 10.9 Hu
003 10.7 Wa
006 11.0 Wr
007 11.0 Hi
008 11.1 Wa
009 11.2 Jo
009 11.0 Pt
012 11.3 B
013 11.2 Gy
015 11.2 El

T Cas
001755
983 12.4 Jo
991 12.1 L
001 12.1 B
002 12.4 Jo
004 12.1 L
007 12.2 Wr
009 12.1 Pt
009 12.5 Jo
011 12.2 Me

R And
001838
982[12.6 An
003[13.7 B
009[13.7 Pt

S Tuc
001862
952 11.0 Ht
974 10.2 Ht
975 10.1 Bl

S Tuc
001862
976 10.0 En
978 10.0 En
979 10.0 Ht
981 10.0 En

S Cet
001909
980 8.5 Jo
982 8.9 An
983 9.7 Si
984 8.7 Jo
989 9.0 Ko
991 9.0 L
996 9.2 Me
001 10.5 Si
002 10.0 Bc
002 9.5 Jo
003 10.0 Ko
003 9.8 Sf
006 10.2 L
007 10.0 El
008 10.3 We
008 10.2 Wa
008 10.2 Sf
009 10.1 Pt
009 10.1 Wa
011 10.0 Jo
017 10.5 El

T Scl
002438a
978 10.5 En

T Phe
002546
952 11.0 Ht
958 10.4 Sl
974 9.5 Ht
975 9.8 Bl
976 9.7 En
978 9.7 En
979 9.5 Ht
981 9.8 En

W Scl
002833
975 13.0 Bl
978 13.0 En

U Cas
004047a
009[13.1 Pt

V And
004435
983 10.4 Jo
985 10.3 Jo
988 10.1 Jo
992 10.2 L
003 9.9 Jo
003 10.0 B
004 9.9 L

X Scl
004435
975 13.3 Bl
978 13.0 En

RR And
004533
983 9.4 Jo
985 9.3 Jo
988 9.2 Jo
002 9.0 Jo
003 9.2 B
004 9.4 El
008 9.0 El
009 8.8 Jo
010 9.2 Me
017 9.3 El

RV Cas
004746a
002 12.6 B
009 11.2 Pt
010 11.0 Me

— Cas
004746b
009 10.8 Pt
010 10.7 Me

W Cas
004958
979 11.9 BL
983 11.7 Jo
001 11.2 B
001 12.3 Ko
002 11.7 Jo
002 11.9 El
002 11.8 BL
008 11.7 El
009 11.6 BL
009 11.8 Pt
009 12.3 Jo
011 12.3 Ko
011 11.6 Me
015 11.7 Bw
017 11.7 El
026 11.4 BL

U Tuc
005475
952 8.5 Sl
953 8.8 Ht
957 8.5 Sl
974 9.0 Ht
975 9.0 Bl
976 8.9 En
977 9.0 Sl
978 9.2 En
979 9.2 Ht
981 9.2 En

Z Cet
010102
000 12.8 L
007 12.2 El
009 11.4 Pt
009 12.1 Ko
010 11.6 L
015 11.4 El

U Scl
010630
975[13.2 Bl
978[12.0 En

U And
010940
997 12.9 L
004 12.6 El
009 12.6 L
013 11.8 Gy
013 11.9 B
015 11.7 El
034 10.9 Gy

UZ And
011041
991 11.0 L
004 12.6 L
005 11.3 B

S Psc
011208
983 10.0 Jo
997 10.1 L
005 10.4 Jo
008 10.4 El
009 10.2 L
015 10.6 El

S Cas
011272
009[13.2 Pt
013[13.7 B

U Psc
011712
997[12.8 L
009[12.8 Pt
010 14.5 L

RZ Per
012350
984 10.4 Jo
991 10.3 Jo

RZ Per
012350
992 11.0 L
003 10.0 Jo
004 10.3 L
011 10.2 Me
013 10.0 B

R Psc
012502
983 8.4 Jo
984 8.4 We
988 8.7 Ah
003 9.2 Ah
009 9.2 We
009 9.7 Pt
010 9.3 Me
034 10.8 Gy

RU And
013238
988 12.3 Jo
992 11.4 L
002 11.5 Jo
004 11.2 L
005 10.8 B
008 11.6 We
009 11.8 Jo
009 11.2 Pt
011 11.4 Me
013 11.2 Gy
034 11.0 Gy

Y And
013338
983 9.0 Jo
988 9.3 Jo
992 9.9 L
002 10.4 Jo
003 10.3 Sf
004 10.6 L
005 10.5 B
008 10.6 We
008 10.8 Sf
009 11.0 Pt
009 10.7 Jo
011 10.9 Me
013 11.0 Gy

X Cas
014958
982 11.8 Bn
983 11.8 Jo
987 11.8 Bn
999 11.5 Bn
002 11.0 Jo
003 11.2 Ah
007 11.1 Bn
009 10.7 Jo
009 10.1 Pt
013 10.0 B
017 10.5 Me

RR Ari
015023
002 5.7 Mc
006 6.0 Mc
012 5.6 Mc

U Per
015254
979 8.5 BL
980 7.7 Jo
983 8.5 We
984 8.0 Jo
988 7.7 Jo
991 8.3 Ry
996 8.2 Me
001 8.1 Mc
002 8.2 Mc
002 8.1 Jo
002 8.0 BL
003 8.0 Ah
005 8.2 Hl
006 8.3 Mc
007 8.3 Ry
009 8.9 Jo
009 8.2 We
009 8.3 BL
009 7.9 Pt
012 8.4 Mc
012 8.4 Ry
013 8.5 B
026 8.5 BL

S Ari
015912
991[13.3 L
004 14.0 L

R Ari
021024
980 11.0 Jo
984 11.8 Jo
988 12.1 Jo
992 12.1 L
004 12.9 L
011 13.0 L

W And
021143a
980 9.2 Jo
984 9.5 Jo
988 9.6 Jo
002 9.8 Jo
002 10.4 Ko
009 10.8 Jo
009 10.5 Pt
010 10.7 Me
013 11.2 Gy
034 11.7 Gy

T Per
021258
953 8.9 Hr
979 9.1 BL

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMREB, 1932.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

T PER
021258
980 8.5 Jo
983 8.9 We
988 9.3 Hr
996 8.6 Me
002 8.9 BL
002 8.6 Jo
003 8.8 Ah
004 9.0 El
005 9.1 Hl
009 8.8 Pt
009 8.7 BL
015 9.0 El
026 8.7 BL

Z CEP
021281
009[12.5 Pt

o CET
021403
952 8.0 Sl
980 8.5 Jo
983 8.7 Cy
983 8.8 Si
984 9.2 We
988 9.2 Ah
988 8.6 Jo
988 9.0 Cy
992 8.6 L
002 9.3 Cy
002 9.3 BL
003 9.2 Ah
003 8.7 Jo
003 9.2 Me
006 8.7 L
008 9.2 Wd
008 9.0 Cy
008 9.1 Hf
009 8.7 Jo
009 9.2 BL
009 9.1 Pt
016 9.2 Wd
026 9.4 BL

S PER
021558
979 9.8 BL
980 9.3 Jo
983 9.9 We
988 9.9 Hr
995 9.3 Sz
996 9.9 Me
002 9.2 Jo
002 9.5 El
002 9.6 BL
003 9.4 Ah
004 9.4 El
005 9.3 Hl
008 9.4 El
008 9.4 Hf
008 9.5 Wd

S PER
021558
009 9.5 Pt
009 9.0 Jo
009 9.3 We
009 9.6 BL
015 9.4 El
019 9.4 B
026 9.6 BL

R CET
022000
991 8.0 L
003 7.6 Me
003 8.2 Jo
004 7.6 L
008 8.2 Wd
008 8.0 Hf
009 7.7 Jo
011 7.9 L

RR PER
022150
991 9.0 Jo
992 8.9 L
004 9.4 Jo
006 8.4 L
009 8.3 Pt
009 9.0 We
016 8.1 Mc
019 8.0 B

R FOR
022426
975 10.3 Bl
003 11.6 Me

U CET
022813
991 11.0 L
005 11.3 Jo
006 11.6 L
009 12.2 Pt
011 11.5 Jo

RR CEP
022980
009[12.9 Pt

R TRI
023133
980 9.4 Jo
984 9.6 Jo
988 9.3 Ah
991 8.9 Jo
002 8.6 Jo
003 8.7 Ah
003 8.8 Sf
008 8.5 Sf
008 8.3 Me
009 8.4 Jo
009 8.0 Pt
013 8.2 Gy
013 8.6 Sh
016 8.0 Wd
034 7.0 Gy

T ARI
024217
980 9.4 Jo
984 9.5 Jo
987 9.9 Ko
988 9.7 Ah
002 10.8 Ko
003 10.2 Mc
003 9.9 Jo
009 10.6 Jo

W PER
024356
980 8.8 Jo
982 9.3 Cy
983 9.4 We
988 8.8 Jo
989 9.0 Ko
989 9.7 Cy
991 8.8 Jo
991 9.2 Ry
994 9.2 Ry
999 9.4 Mc
001 9.7 Mc
002 9.7 Mc
002 9.0 Jo
002 9.1 Ko
003 9.3 Hl
006 9.9 Mc
007 9.2 Ry
008 9.4 Mc
009 9.3 We
009 9.8 Cy
009 9.0 Jo
012 9.9 Mc
012 9.2 Ry
015 9.1 Pt
019 9.6 Mc

R HOR
025050
952 7.9 Sl
953 8.6 Ht
959 8.0 Sl
974 9.5 Ht
975 8.8 Bl
977 9.5 En
979 9.6 Ht
981 9.8 En

T HOR
025751
952 8.2 Sl
953 8.8 Ht
959 8.0 Sl
974 8.1 Ht
975 8.0 Bl
977 7.7 En
979 8.0 Ht
981 7.7 En

U ARI
030514
992 12.1 L

U ARI
030514
006 12.5 L

X CET
031401
980 9.6 Jo
991 9.4 Jo
991 9.8 L
003 9.2 Jo
004 9.1 L
008 9.3 El
009 9.5 Jo
011 9.4 L
014 9.5 Mc
015 8.9 El
015 9.6 Lg
015 9.0 Pt
017 9.2 El
026 9.1 Lg
034 8.9 Gy

Y PER
032043
980 9.0 Jo
984 9.4 Jo
985 10.2 Ah
988 9.3 Jo
989 9.8 Ko
996 9.4 Me
001 9.3 Mc
002 9.2 Mc
002 8.9 Ko
002 9.3 El
003 9.6 My
003 8.8 Jo
003 9.7 Ah
005 9.2 Fq
006 9.1 Mc
009 8.5 Jo
009 9.3 We
009 9.2 BL
010 8.5 Fq
012 9.1 Mc
015 8.6 Pt
015 9.4 El
026 8.7 BL

R PER
032335
997 11.7 L
002 11.0 Jo
002 11.0 El
009 9.0 Jo
009 10.3 L
013 10.2 Lg
014 9.8 Me
015 10.0 El
015 9.8 Pt
029 9.4 My

NOV PER
032443
015 13.1 Pt

T FOR
032328
991 9.0 L
004 9.0 L

R TAU
042209
015[13.0 Pt

W TAU
042215
980 10.8 Jo
981 10.2 Cy
984 11.0 Jo
988 10.2 Cy
991 10.9 L
002 10.8 Cy
002 10.6 We
003 10.4 Bw
003 10.5 Jo
006 10.9 L
009 10.8 Cy
009 10.7 Jo
015 10.6 Pt
016 10.5 Bw
026 10.6 Lg

S TAU
042309
015 12.5 Pt

T CAM
043065
980 7.9 Jo
984 8.2 Jo
987 7.9 Ko
992 8.0 L
002 8.5 We
002 8.4 Jo
003 8.0 My
004 7.6 L
008 8.2 Hf
008 8.4 Wd
009 7.9 Jo
011 7.9 Ko
011 7.7 L
016 8.2 Me
017 8.2 Pt

RX TAU
043208
997 12.8 L
008 12.8 El
009 12.9 L
016 13.4 Bw
017 13.2 El

R RET
043263
956 8.3 Ht
959 8.1 Sl
975 9.3 Bl
976 9.3 En
976 9.7 Ht

X CAM
043274
980 8.1 Jo
984 8.4 Jo
992 8.5 L
999 8.4 Me
002 8.6 We
003 8.5 Jo
003 8.4 My
004 8.4 L
009 8.7 Jo
010 9.0 Hf
010 9.1 Wd
011 8.8 L
016 9.7 Me
017 9.4 Pt
020 9.8 Me

R DOR
043562
952 5.1 Sl
956 5.2 Ht
959 4.8 Sl
975 5.4 Bl
976 5.3 En
976 5.5 Ht

R CAE
043738
956 11.1 Ht
975 9.6 Bl
976 9.8 Ht

R PIC
044349
956 7.5 Ht
975 7.1 Bl
976 7.2 Ht

V TAU
044617
980 9.0 Jo
984 9.4 Jo
017 12.3 Pt

R ORI
045307
991 11.2 L
006 10.2 L

R LEP
045514
958 7.5 Sl
983 8.8 Jo
989 8.3 Jo
989 8.0 Ko
991 8.7 L
003 8.1 Jo
006 8.2 L
011 8.2 L
011 7.8 Jo
017 7.8 Pt
034 9.5 Gy

V ORI
050003
997 12.0 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMREB, 1932.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

V ORI
050003
005 11.0 Jo
009 10.8 Jo
009 10.8 L
015 10.6 Me
017 10.5 Pt

T LEP
050022
975 11.3 Bl
989 11.3 Ko
008 11.3 Hl
011 10.0 Jo
017 11.2 Pt

S PIC
050848
956[12.9 Ht
975 13.4 Bl

AE AUR
050934
002 6.0 Mc
012 6.2 Mc

R AUR
050953
975 11.7 Bl
003 11.8 Jo
005 11.5 Jo
009 11.0 Jo
010 10.3 Mn
011 10.1 Mn
016 10.1 Wd

T PIC
051247
976 11.8 Ht

T COL
051533
956 11.1 Ht
975 9.9 Bl
976 10.1 Ht

S AUR
052034
980 8.8 Jo
986 10.0 We
989 9.2 Ko
002 9.5 Mc
002 8.8 Jo
003 8.7 Jo
003 9.1 Ko
009 8.9 Jo
017 8.5 Pt
022 9.3 Me
034 9.4 Gy
036 9.3 Gy

W AUR
052036
980 9.0 Jo
986 9.8 We
992 9.5 L
003 9.5 Jo
006 9.4 L

W AUR
052036
008 10.2 Hf
008 10.1 Wd
009 10.4 Wa
011 10.0 Jo
017 10.4 Pt

S ORI
052404
005 8.9 Jo
008 9.7 El
009 8.5 We
015 9.7 Me
017 9.7 El
017 9.0 Pt
022 9.8 Me
034 10.1 Gy

T ORI
053005a
982 10.9 Hr
983 10.4 Jo
988 10.9 Hr
989 9.8 Jo
989 9.9 Ko
991 10.1 L
992 10.6 Hr
993 10.8 Hr
997 9.9 L
999 10.0 Me
000 10.1 Me
002 10.4 Me
003 10.1 Me
003 10.0 My
003 10.5 Jo
003 10.0 Ko
004 9.8 Pt
004 10.1 L
006 10.1 L
007 10.2 Pt
008 10.0 Me
009 10.1 L
010 10.4 L
011 10.2 L
011 10.6 Jo
014 10.1 Me
015 10.1 Me
015 9.7 Pt
015 9.9 Lg
017 10.0 Me
022 9.8 Me
029 9.6 My

AN ORI
053005f
015 12.1 Me

S CAM
053068
830 10.0 BL
980 8.3 Jo
983 8.7 Si
984 8.5 Jo

S CAM
053068
002 8.4 Jo
002 8.5 We
009 8.1 Jo
010 8.6 Hf
010 8.8 Wd
017 8.3 Pt

RR TAU
053326
989 11.0 Ko
997 11.6 L
002 11.3 Me
002 11.8 Pt
003 11.8 Ko
003 11.6 Me
004 11.6 L
004 11.7 Pt
006 11.7 Me
006 11.6 L
007 11.8 Pt
008 11.0 Ko
008 11.2 Me
009 11.5 L
009 11.7 Pt
010 11.1 L
011 11.0 L
013 11.3 Gy
014 11.1 Me
015 10.8 Me
015 11.5 Pt
017 12.5 Pt
017 12.4 Me
022 12.5 Me
034 12.2 Gy
036 11.7 Gy

RU AUR
053337
016[13.4 Bw
017[12.0 Pt

U AUR
053531
002 13.1 L
010 13.7 L
017 13.2 Pt

SU TAU
054319
981 9.2 Cy
983 9.3 Cy
988 9.3 Cy
989 9.5 Ko
990 9.3 Cy
997 9.5 L
999 9.6 Me
002 9.3 Cy
002 9.6 Me
002 9.5 Pt
003 9.5 Ko
003 9.6 Me
004 9.6 L

SU TAU
054319
004 9.6 Pt
006 9.6 Me
006 9.4 L
007 9.6 Pt
008 9.5 El
008 9.5 Me
008 9.5 We
009 9.1 Cy
009 9.6 L
009 9.6 Pt
010 9.4 L
011 9.6 L
014 9.5 Me
015 9.6 Me
015 9.3 Lg
015 9.6 Pt
017 9.6 Pt
017 9.5 Me
017 9.4 El
022 9.6 Me
034 9.4 Gy
036 9.3 Gy

S COL
054331
975 12.0 Bl
976 12.2 Ht

Z TAU
054615a
004 13.7 L

RU TAU
054615c
004 12.9 L

R COL
054620
975 10.3 Bl

α ORI
054907
982 0.6 Si
983 0.4 Si
999 0.8 Si

U ORI
054920a
958 11.2 Sl
002 9.5 Mc
005 8.9 Jo
008 9.1 Hf
008 9.2 We
008 9.1 Wd
009 9.0 Wd
009 8.8 Sh
011 8.6 Jo
015 8.4 Me
016 8.5 Wd
017 8.0 Pt
034 6.6 Gy
036 7.4 Gy

V CAM
054974
010 13.9 L
017[12.8 Pt

Z AUR
055353
980 9.8 Jo
984 10.2 Jo
988 10.4 Ah
001 10.2 Pt
002 10.5 Mc
003 9.8 Jo
004 10.2 Pt
007 10.2 Pt
008 10.1 Me
009 9.7 Jo
014 10.5 HS
015 10.5 HS
015 10.2 Pt
017 10.1 Pt
022 10.7 Me

R OCT
055686
953 9.6 Sl
954 10.0 Bl
956 10.0 Ht
969 8.8 Ht
975 8.7 Bl
976 8.5 Ht

X AUR
060450
000 11.5 L
005 10.6 Jo
009 10.3 Wa
010 10.8 L
015 10.2 Me
017 9.5 Pt

V AUR
061647
000 10.8 L
005 10.3 Jo
010 12.1 L
015 12.1 Me
034 11.8 Gy
036 12.3 Gy

V MON
061702
989 10.6 Ko
017 11.7 Pt

AG AUR
062047
000 9.9 L
010 10.0 L

NOV PIC
063462
956 8.3 Ht
976 8.4 Ht

S LYN
063558
010 13.8 L

X GEM
064030
005 13.7 Bn
034 12.7 Gy

Y MON
065111
997 10.9 L
009 10.8 L
017 10.5 Pt

X MON
065208
997 8.2 L
009 7.9 L
034 7.3 Gy

R LYN
065355
983 8.4 Jo
988 8.6 Ah
000 8.0 L
001 8.3 Mn
003 8.2 Ah
010 8.1 L
011 8.0 Jo
011 8.2 Mn

RS GEM
065530
008 11.6 Me
015 10.5 Pt
022 10.5 Me

Z CMA
065911
958 9.6 Sl

V CMI
070109
989 10.7 Jo
997 8.7 L
009 8.7 L
015 9.6 Pt
034 9.9 Gy

R GEM
070122a
989 11.7 Jo
008 10.2 Wd
008 10.3 Hf
011 9.4 Jo
015 9.3 Pt
022 8.6 Me

Z GEM
070122b
015 12.5 Pt

TW GEM
070122c
015 8.2 Pt

R CMI
070310
989 9.5 Jo
997 10.4 L
009 10.6 L
015 11.0 Pt
034 11.3 Gy

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

R VOL
070772
956[12.6 Ht
976[12.6 Ht
L₂ PUP
071041
958 4.3 Sl
RR MON
071201
004[13.4 L
V GEM
071713
997 8.7 L
008 8.8 El
010 8.6 L
015 9.0 Pt
017 9.2 El
S CMI
072708
830 10.5 BL
989 10.4 Jo
989 9.5 Ko
015 10.3 Pt
T CMI
072811
015[12.9 Pt
S VOL
073173
954 9.8 Bl
956 10.2 Ht
969 11.0 Bl
974 11.0 Bl
976 10.5 Ht
U CMI
073508
989 9.3 Jo
997 10.1 L
009 10.4 L
015 10.4 Pt
S GEM
073723
015[13.5 Pt
T GEM
074323
015 13.0 Pt
R CNC
081112
981 9.0 Cy
989 9.5 Jo
990 9.6 Cy
009 10.2 Cy
015 10.5 Pt
V CNC
081617
981 9.8 Cy
990 10.5 Cy
997 11.0 L
008 12.1 Cy
010 11.3 L
015 12.5 Pt

RT HYA
082405
989 7.4 Ko
002 7.4 L
008 7.4 El
011 7.4 L
015 7.3 Pt
017 8.0 El
R CHA
082476
954 9.2 Bl
956 9.3 Ht
959 8.7 Sl
969 8.5 Bl
974 8.6 Bl
976 8.8 Ht
U CNC
083019
010 14.4 L
017 14.1 El
X UMA
083350
989 10.0 Jo
003 10.4 Jo
015 10.6 Pt
S HYA
084803
015 10.2 Pt
017 9.8 El
T HYA
085008
002 8.6 L
009 9.2 Cy
011 9.1 L
015 9.4 Pt
T CNC
085120
830 9.5 BL
989 8.4 Jo
009 9.2 Cy
015 8.2 Pt
V UMA
090151
997 10.5 L
002 10.5 Mc
010 10.4 L
012 10.2 Mc
022 10.6 Me
W CNC
090425
997 9.9 L
010 10.0 L
015 10.3 Pt
RW CAR
091868
969[12.8 Bl
R CAR
092962
952 6.5 Sl
954 6.5 Bl

R CAR
092962
958 6.7 Sl
969 7.3 Bl
974 7.9 Bl
X HYA
093014
015 9.5 Pt
Y DRA
093178
981 11.2 Cy
988 11.9 Cy
004 13.1 L
R LMI
093934
989 9.1 Jo
015 10.6 Pt
R LEO
094211
830 8.6 BL
989 9.0 Jo
000 9.3 Me
015 8.5 Pt
022 8.8 Me
L CAR
094262
958 3.5 Sl
Y HYA
094622
015 6.6 Pt
V LEO
095421
015 13.6 Pt
RV CAR
095563
969[13.1 Bl
S CAR
100661
954 8.1 Bl
957 7.8 Sl
969 6.6 Bl
974 6.0 Bl
U UMA
100860
998 6.6 Mn
001 6.5 Mn
007 6.4 Mn
011 6.5 Mn
Z CAR
101058a
954[12.6 Bl
W VEL
101153
954 10.1 Bl
969 10.7 Bl
974 10.6 Bl
R UMA
103769
980 11.4 Jo
988 11.9 Jo

R UMA
103769
988 11.7 Cy
003 11.5 Ah
008 12.2 El
009 11.8 Sz
015 12.2 Pt
017 12.2 Fl
V HYA
104620
997 6.8 L
010 6.8 L
015 6.5 Pt
W LEO
104814
997 11.1 L
010 11.1 L
015 10.8 Pt
S LEO
110506
009 13.4 L
015[13.1 Pt
RY CAR
111561
954 13.3 Bl
969 12.2 Bl
974 11.4 Bl
RS CEN
111661
954 12.5 Bl
969 9.9 Bl
974 9.4 Bl
X CEN
114441
954 10.7 Bl
969 11.8 Bl
AD CEN
114858
956 9.6 Ht
W CEN
115058
954 13.0 Bl
969 13.0 Bl
974 13.0 Bl
R COM
115919
830 9.6 BL
SU VIR
120012
997[11.7 L
010 13.5 L
015[12.0 Pt
T VIR
120905
010 10.1 L
R CRV
121418
952 9.0 Sl
022 11.7 Me

SS VIR
122001
004 7.4 L
011 7.7 L
T CVN
122532
015 9.6 Pt
Y VIR
122803
011 9.5 L
U CEN
122854
953 8.0 En
954 8.1 Bl
956 8.1 Ht
957 8.0 En
969 8.4 Ht
969 8.2 Bl
974 8.6 Bl
976 8.9 Ht
T UMA
123160
001 12.8 Pt
015 12.8 Pt
R VIR
123307
022 8.0 Me
RS UMA
123459
007 13.2 Ry
012 13.0 Ry
015 13.3 Pt
017 12.5 El
S UMA
123961
980 7.9 Jo
984 7.8 Jo
985 8.0 Ah
988 7.9 Ah
992 7.8 Ah
998 8.1 Mn
001 7.8 Mn
001 7.7 Mc
001 8.1 Th
001 8.0 Pt
002 7.8 Mc
002 7.7 Jo
003 7.6 Ah
004 7.8 Ah
005 7.9 Th
005 7.8 Mn
006 8.0 Mc
006 8.1 Wr
007 7.9 Mn
009 7.6 Sz
009 7.7 Jo
010 7.7 Ah
011 7.7 Mn
012 8.0 Mc
013 8.3 Gy

S UMA
123961
014 8.0 Hu
015 8.0 Pt
017 7.8 El
034 8.4 Gy
RU VIR
124204
010[12.3 L
U VIR
124606
007 9.0 L
011 9.0 L
022 10.0 Me
U OCT
131283
953 10.2 En
954 10.2 Bl
956 10.5 Ht
969 10.3 Ht
969 10.1 Bl
974 10.1 Bl
976 10.5 Ht
977 10.0 En
981 9.9 En
V CVN
131546
988 7.9 Th
994 8.0 GD
R HYA
132422
952 9.2 Sl
953 9.3 En
954 9.1 Bl
956 9.6 Ht
969 9.5 Ht
969 9.5 Bl
974 9.3 Bl
976 9.6 Sl
S VIR
132706
952 7.2 Sl
956 7.5 Ht
RV CEN
133155
953 10.0 En
954 9.7 Bl
956 10.5 Ht
969 10.2 Ht
969 9.5 Bl
974 9.5 Bl
976 10.3 Ht
T UMI
133273
994 13.8 L
006 13.3 L
011 13.3 L
T CEN
133633
952 6.2 Sl

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

T CEN
133633
952 6.4 Ht
953 6.3 En
954 6.2 Bl
957 6.2 Sl
969 6.2 Ht
969 6.5 Bl
974 6.8 Bl
976 6.2 Ht
976 6.2 Sl

RT CEN
134236
952 9.9 Ht
953 9.3 En
954 9.4 Bl
969 9.3 Bl
969 9.7 Ht
974 9.4 Bl
976 9.5 Ht

R CVN
134440
830 9.8 BL
980 10.5 Jo
984 10.1 Jo
001 9.7 Pt
015 9.2 Pt

RX CEN
134536
952 10.8 Ht
953 11.1 En
954 10.6 Bl
969 9.5 Bl
969 9.7 Ht
974 9.3 Bl
976 9.6 Ht

T APS
134677
953 11.0 En
954 10.8 Bl
956 10.9 Ht
969 10.4 Ht
969 9.7 Bl
969 9.5 En
974 10.1 Bl
976 9.2 Ht
977 9.0 En

RU HYA
140528
952 10.0 Ht
953 9.9 En
954 9.9 Bl
969 10.8 Ht
969 10.6 Bl
974 11.0 Bl
976 11.2 Ht

R CEN
140950
953 7.0 En
954 6.8 Bl

R CEN
140950
956 6.4 Ht
956 6.9 En
957 6.4 Sl
957 6.9 En
969 6.9 En
969 6.7 Bl
969 6.6 Ht
974 6.7 Bl
976 6.4 Ht
977 6.0 Sl
977 6.6 En

U UMI
141567
983 11.7 Cy
984 11.2 Jo
988 11.3 Ah
000 11.4 Hi
001 11.8 Pt
002 11.4 Jo
003 11.2 Cy
003 11.7 Ah
004 11.4 Me
009 11.5 Jo

S BOO
141954
830 8.7 BL
001 12.3 Pt
002 12.0 Jo
005 11.3 Jo
009 10.7 Jo
010 11.2 L
014 10.8 Me

RS VIR
142205
984 7.8 Ko

V BOO
142539a
980 8.6 Jo
985 8.3 Jo
985 8.7 Ah
991 7.8 Jo
998 8.3 Mn
999 8.4 Me
001 8.2 Mn
001 8.3 Mc
001 8.0 Pt
002 8.6 Mc
002 8.0 Jo
003 8.2 Ah
005 7.8 Mn
006 8.5 Mc
008 7.8 Cy
009 7.9 Jo
011 7.8 Mn
012 8.2 Mc

R CAM
142584
980 10.1 Jo

R CAM
142584
983 9.8 Jo
985 9.5 Jo
988 9.0 Cy
001 8.4 We
002 8.8 Hi
002 8.6 Jo
003 9.0 Cy
008 8.4 Oy
009 8.4 Jo

R BOO
143227
999 12.0 Me
001 12.5 Pt

S LUP
144646a
953 12.1 En
969 11.2 En
977 10.7 En

U BOO
144918
980 10.6 Cy
004 11.3 Me

Y LUP
145254
954[13.7 Bl
977[12.4 En

S APS
145971
952 12.6 Ht
953 12.4 En
954 12.4 Bl
956 12.4 Ht
956 12.4 En
962 12.1 Bl
969 12.1 Bl
969 12.3 Ht
969 12.2 En
974 12.2 En
974 12.0 Bl
976 12.3 Ht
976 12.2 En
981 12.0 En

S LIB
151520
942 10.2 Ch

S SER
151714
975 8.2 Cy
992 7.7 L
001 8.0 Pt
006 7.7 L
012 7.9 L

S CRB
151731
980 8.3 Jo
983 8.3 Si
984 7.9 Jo
985 7.7 Ah

S CRB
151731
988 7.6 Jo
989 7.7 Ko
991 7.5 Jo
998 7.8 Mn
999 7.9 Me
001 8.0 Pt
001 8.0 Ko
001 7.6 El
002 7.6 Jo
003 8.0 Ah
005 7.7 Mn
006 8.3 Wr
007 7.8 El
008 8.4 We
009 7.7 Jo
009 8.2 Sz
011 7.6 Mn

RS LIB
154428
151822
952 10.0 Ht
953 10.0 En
954 9.9 Bl
969 10.4 Ht
969 10.3 Bl
969 10.4 En
974 10.3 Bl
976 11.2 Ht
977 11.0 En

R NOR
152840
953 10.4 En
954 10.3 Bl
956 10.4 Ht
969 11.0 Ht
969 10.7 Bl
969 10.6 En
974 10.8 Bl
976 11.0 Ht
977 10.9 En

X LIB
153020
954 11.0 Bl
969 11.2 Bl
974 11.6 Bl

W LIB
153215
962 11.9 Bl
969 13.0 Bl
974[12.5 Bl

S UMI
153378
983 10.5 Jo
987 11.5 Ko
988 11.3 Ah
989 10.7 Jo
995 11.6 Me
001 11.6 Pt

S UMI
153378
002 11.8 Ko
003 10.7 Jo
009 11.4 Jo

U LIB
153620a
969[12.9 Bl

T NOR
153654
953 10.5 En
956 10.5 Ht
969 10.9 Ht
969 11.0 En
976 11.3 Ht
977 11.1 En

Z LIB
154020
969[12.7 Bl

R CRB
154428
952 6.1 Hr
953 6.1 Hr
954 6.0 Cy
975 6.0 Cy
975 6.0 Rc
979 6.0 Cy
980 6.0 Cy
980 6.0 Hr
980 6.1 Jo
981 6.0 Cy
982 6.0 Hr
983 5.9 Si
983 6.0 Cy
983 5.9 Ko
983 6.1 Rc
984 6.0 Hr
984 6.0 Mg
984 6.2 We
984 6.0 Be
984 6.0 L
984 6.0 HS
985 6.2 Ah
985 6.0 Hr
987 6.0 Ko
988 5.8 HS
989 6.0 Cy
989 6.0 Ko
991 5.9 Hr
991 5.8 Jo
991 6.0 L
992 6.0 Oy
994 5.9 Pt
995 5.9 Pt
995 6.1 Wd
996 6.0 Rc
996 6.0 L
996 6.1 Me
997 6.0 Hu
998 6.1 Me
998 5.9 L
998 6.0 Mn
999 5.9 Si
999 6.1 Me
000 6.1 Me
000 6.1 We
001 6.1 Mn
001 5.9 Si
001 6.0 Hc
001 5.9 Mg
001 5.9 Mc
001 6.0 Ko
001 5.7 Pt
002 5.7 Pt
002 6.0 Cy
002 6.0 Mc
002 6.0 Jo
002 5.8 Hu
002 6.0 Be
003 6.0 Be
003 6.0 Cy
003 6.1 Ah
004 6.0 Me
004 6.1 Rc
005 6.1 Mn
005 6.1 Me
005 5.7 Pt
006 5.9 Mc
006 6.0 Me
006 6.0 L
007 5.8 We
007 6.0 Me
008 6.1 Me
008 6.0 Si
008 5.9 Ko
009 6.0 Oy
009 5.9 Se
009 6.1 Sz
009 6.0 Mg
009 5.8 Jo
009 5.8 Pt
010 5.9 Ko
010 6.0 Ah
010 6.2 Me
011 6.1 Me
011 5.9 Mn
011 6.0 L
012 6.0 L
012 6.0 Rc
012 6.1 Me
012 5.9 Mc
012 6.0 Bc
014 6.1 Me
014 5.9 Pt
014 6.0 GD
015 6.1 Wd

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R CrB	RZ Sco	SX Her	W Oph	R Dra	RT Sco
154428	*155823*	160325	*161607*	163266	*165636*
015 6.1 Se	953 10.4 En	007 8.7 Me	001[12.5 Pt	001 10.5 El	953[12.1 En
016 6.0 Me	969 11.3 Ht	008 8.7 Me	V Oph	001 10.1 Pt	970[14.0 Bl
017 6.0 Me	976 11.2 Ht	009 8.7 Pt	*162112*	003 9.6 Jo	R Oph
017 5.7 Pt	977 11.5 En	010 8.5 Me	992 8.3 L	003 10.1 Ah	*170215*
020 6.0 Me	Z Sco	011 8.7 Me	001 9.0 Pt	005 10.1 Mn	951 9.7 Ch
021 5.8 Me	*160021*	011 8.3 L	U Her	007 10.2 El	952 10.0 Vh
X CrB	952 9.7 Ht	012 8.4 Me	162119	008 10.2 Hf	969 9.3 Wd
154536	953 9.7 En	014 8.4 Me	998 11.8 B	008 10.1 Wd	973 9.2 Bw
999 11.6 B	962 9.4 Bl	016 8.4 Me	001 11.9 Pt	008 9.2 Hu	975 8.6 Rc
999 11.4 Mc	969 10.1 Bl	017 8.1 Me	003 12.3 Jo	009 9.4 HS	976 8.5 Gy
000 11.0 Hi	969 10.3 Ht	017 8.3 Pt	009 12.0 Jo	009 9.5 Jo	979 8.3 Gy
001 10.9 Pt	974 9.9 Bl	019 8.0 Me	SS Her	011 9.7 Mn	991 7.3 L
006 10.9 L	976 10.3 Ht	020 8.0 Me	162807	011 9.2 HS	001 7.2 Pt
008 10.4 We	977 10.0 En	021 8.1 Me	980 11.9 Cy	013 9.3 HS	002 7.2 Jo
009 10.5 Cy	R Her	W Sco	982 11.8 Be	014 9.2 HS	005 7.3 Jo
012 10.6 L	160118	*160519*	982 11.8 An	015 9.1 HS	007 7.1 L
R Ser	980 10.0 Jo	969 13.2 Bl	992 12.1 L	016 9.3 Wd	RT Her
154615	983 9.7 Jo	974 12.7 Bl	999 12.3 B	022 8.7 Wd	170627
001 8.1 Pt	984 9.1 We	RU Her	001 11.8 Pt	RR Oph	999 13.7 B
004 8.2 Me	988 9.8 Jo	160625	004 11.9 Mc	*164310*	001[13.4 Pt
008 7.7 Cy	989 9.9 Ko	980 9.1 Jo	006 11.8 L	953[12.0 En	RW Sco
V CrB	001 9.7 Ko	982 9.7 Be	011 11.8 L	977[12.0 En	*170833*
154639	001 9.7 Pt	982 9.6 An	T Oph	S Her	970 13.0 Bl
830 10.8 BL	002 9.9 Jo	983 9.8 Si	*162815*	164715	975 12.8 Bl
980 7.1 Jo	004 9.5 We	984 9.2 We	969[12.8 Bl	984 10.4 We	Z Oph
984 7.3 Jo	004 9.9 Mc	985 10.1 Ah	S Oph	997 12.2 Jo	171401
985 7.3 Ah	008 9.2 Cy	987 10.0 Ko	*162816*	999 12.4 B	983 8.1 Jo
988 7.9 Th	009 9.8 Jo	992 9.8 L	970[13.2 Bl	001 12.0 Pt	984 9.0 We
991 7.2 Jo	U Ser	996 10.5 Mc	W Her	005 12.4 Jo	985 9.0 Ah
000 8.2 Hi	160210	998 10.3 B	163137	RS Sco	991 8.3 Jo
001 8.4 Mc	982[12.0 An	001 10.5 Ko	982 12.7 An	*164844*	998 9.1 B
001 7.0 Pt	001[12.3 Pt	001 9.8 Pt	999 13.1 B	952 11.6 Ht	002 9.2 Hu
002 8.5 Mc	X Sco	002 10.2 Jo	001 13.1 Pt	953 12.5 En	003 9.2 Ah
002 7.6 Jo	*160221a*	004 10.0 We	007 13.3 El	970 12.2 Bl	003 9.4 My
003 7.6 Ah	962 12.8 Bl	006 10.2 L	R UMi	975 12.0 Bl	003 8.6 Jo
004 7.5 Me	969[12.9 Bl	009 10.3 Cy	163172	976 11.9 Ht	005 9.2 Hl
009 8.2 Cy	SX Her	R Sco	980 9.7 Jo	RR Sco	005 8.9 Pt
011 7.6 Jo	160325	*161122a*	984 9.8 Jo	*165030a*	009 8.7 Jo
012 8.6 Mc	980 8.6 Jo	952 12.6 Ht	988 10.2 Jo	952 7.9 Sl	RS Her
R Lup	982 9.2 An	969 11.5 Ht	991 10.1 Jo	952 7.9 Ht	171723
154736	983 8.7 Si	969 10.8 Bl	992 10.6 L	953 8.2 En	983 9.8 Jo
952 10.4 Sl	983 8.5 Ko	969 11.5 En	003 10.4 Jo	962 8.0 Bl	985 9.8 Ah
953 10.6 En	987 8.8 Ko	975 10.7 Bl	006 10.6 L	969 7.2 Ht	986 7.6 We
957 10.7 Sl	992 8.8 L	976 10.8 Ht	009 10.5 Jo	969 7.4 En	998 10.7 B
969 10.6 En	995 8.8 Pt	977 10.3 En	012 10.6 Me	970 7.4 Bl	002 11.4 Hi
976 10.9 Sl	996 9.0 Me	S Sco	R Dra	975 7.0 Bl	003 11.8 Ah
977 11.0 En	997 9.3 Me	*161122b*	163266	976 7.0 Ht	003 11.4 Jo
Z CrB	998 9.4 Me	953[12.6 En	980 11.5 Jo	976 6.4 Sl	005 11.8 Pt
155229	999 9.0 Me	969[13.4 Bl	983 10.7 Si	977 6.9 En	009 11.7 Jo
959 9.8 Cy	000 9.2 Me	976[12.6 Ht	984 10.7 Jo	SS Oph	019 9.2 B
968 9.7 Cy	001 9.1 Ko	W CrB	988 10.6 Jo	*165202*	S Oct
975 9.8 Cy	002 8.8 Jo	161138	988 11.2 Ah	001 11.7 Pt	*172486*
992 10.6 L	002 8.7 Pt	001 9.8 Pt	991 10.0 Jo	RV Her	953 11.9 Sl
006 11.5 L	004 9.0 Me	003 9.4 Jo	995 10.8 Wd	165631	956 11.9 Ht
009 11.1 Cy	005 9.4 Me	004 9.7 Me	996 10.5 Me	982[13.3 An	969 10.7 Ht
RZ Sco	005 8.8 Pt	005 9.7 B	998 10.2 Mn	001[13.3 Pt	970 10.4 Bl
155823	006 8.6 L	009 9.0 Jo	001 10.1 Mn	010 14.5 L	975 9.7 Bl
952 10.3 Ht	006 9.0 Me	009 9.8 Sz	001 9.2 Si		976 10.0 Ht

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMREB, 1932.

J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
RU OPH		**R PAV**		**RY OPH**		**SV DRA**		**R SCT**		**R SCT**	
172809		*180363*		181103		183149		*184205*		*184205*	
998	13.8 L	954[11.9 En		976	7.6 Sl	984	14.2 L	975	5.9 Rc	003	5.4 Be
999	13.7 B	976[12.3 Ht		983	7.8 Cy	006[14.0 L		976	5.2 Sl	003	5.5 Me
010	14.0 L	T HER		983	7.7 HS	RZ HER		980	5.2 Cy	004	5.6 Me
RT SER		180531		984	8.0 We	183225		980	5.3 Jo	005	5.7 Me
173411		980	8.4 Jo	985	7.6 Ah	006	13.6 L	981	5.2 Hr	005	5.6 Pt
998	13.0 L	982	8.3 Be	003	7.8 Cy	009[13.4 Mg		982	5.3 Bc	006	5.6 Me
010	12.9 L	982	8.4 An	005	8.3 B	X OPH		982	5.5 An	006	5.0 L
RU SCO		983	8.4 We	005	8.0 Pt	183308		982	5.2 Be	006	5.1 Rc
173543		983	8.2 HS	010	8.4 Ah	975	9.3 Rc	983	5.3 Si	007	5.2 Rc
954	9.5 En	988	8.1 HS	W LYR		980	8.5 Jo	983	5.3 Jo	007	5.8 Mn
970	8.6 Bl	988	8.3 Ah	181136		982	9.4 Rc	983	5.4 Ko	007	5.7 Mg
974	8.9 En	991	7.6 Jo	980	7.9 Jo	983	8.2 We	983	5.1 Rc	007	5.3 Bg
975	8.6 Bl	992	7.8 L	982	8.3 Be	983	8.7 Si	984	5.3 Hr	007	5.7 Me
SV SCO		997	7.3 Me	982	8.5 An	983	8.9 Cy	984	5.3 Cy	008	5.2 Oy
174135		999	7.7 B	984	8.3 Jo	984	9.0 An	984	5.5 Mg	008	5.6 Wd
954	12.2 En	000	8.1 We	985	8.5 Ah	984	8.6 L	984	5.0 We	008	5.5 Ko
970	11.1 Bl	001	7.5 El	986	8.2 We	989	8.6 Jo	984	5.7 HS	008	5.5 Hf
974	11.0 En	002	8.0 Hu	988	8.7 Ah	989	8.6 Ko	984	5.4 An	008	5.7 Me
975	10.8 Bl	002	7.9 Wa	992	8.7 L	995	9.2 Rc	985	5.2 Hr	009	5.6 Se
W PAV		003	7.5 Jo	998	9.1 B	998	8.6 L	985	5.7 Mn	009	5.5 Jo
174162		003	7.6 Ah	003	9.4 Jo	998	8.6 Mn	987	5.2 Ko	009	5.3 Ad
954[13.0 En		005	7.8 Pt	003	9.5 Ah	999	8.4 Si	987	5.0 Rc	009	5.4 Pt
970[13.0 Bl		006	7.7 L	003	9.1 Eb	000	8.8 We	988	5.0 Rc	010	5.5 Ko
976[13.0 Ht		008	7.7 El	003	8.9 Co	001	8.4 Mn	988	5.1 Bc	010	5.7 Me
RS OPH		009	7.7 Jo	003	9.2 Sf	001	8.3 Si	989	5.3 Cy	011	5.6 Me
174406		009	7.5 Ad	004	9.6 We	001	8.3 Hc	989	5.2 Ko	011	5.5 L
005	11.0 Pt	009	7.8 HS	005	9.4 Pt	003	9.7 Cy	989	4.9 Rc	011	5.7 Mn
U ARA		010	7.8 Ah	006	9.6 L	003	8.6 Jo	992	5.4 Oy	012	5.6 Me
174551		011	7.9 HS	008	9.7 Wd	003	8.7 Ko	992	5.4 L	012	5.8 Rc
952	12.8 Ht	011	7.6 L	008	9.6 Hf	004	8.9 Rc	994	5.4 Pt	014	5.5 Pt
954	12.6 En	012	7.6 Me	009	9.9 Wd	005	8.2 Pt	994	5.0 Bc	014	5.8 GD
969	11.4 Ht	013	8.2 Gy	009	9.9 Sh	005	8.7 B	994	5.9 GD	014	5.4 Hu
974	10.2 En	013	8.4 HS	009	9.7 Sf	006	9.2 We	995	5.5 Wd	014	5.6 Me
976	10.0 Ht	014	7.9 HS	009	9.5 Jo	007	8.6 L	995	5.0 Rc	015	5.7 Se
RT OPH		014	8.2 Hu	011	9.7 L	007	8.5 Mn	995	5.4 Pt	015	5.6 Wd
175111		015	8.2 HS	016	10.2 Wd	009	8.6 Jo	996	5.4 Me	016	5.6 Me
999	13.0 B	019	8.4 Me	017	10.5 Me	009	8.4 HS	997	5.5 Me	017	5.4 Pt
005[12.5 Pt		034	9.2 Gy	RV SGR		*182133*		010	8.8 Ah	997	5.2 Hu	017	5.5 Me
T DRA		W DRA		*182133*		010	8.6 Be	998	5.6 Bc	018	5.8 GD
175458a		180565		954[12.4 En		010	9.0 An	998	5.7 Mn	020	5.7 Me
009	12.1Mg	984	13.0 L	970	13.5 Bl	011	8.6 HS	998	5.6 Me	021	5.7 Me
UY DRA		998	14.0 L	975	13.1 Bl	011	8.3 Mn	999	5.5 Me	022	5.8 Me
175458b		007	14.0 L	SV HER		012	8.5 Rc	999	5.7 Si	022	5.8 Se
009	11.1 Mg	X DRA		182224		013	8.5 HS	000	5.8 We	022	5.7 Wd
RY HER		180666		983	10.3 Jo	020	8.6 Mc	000	5.5 Me	023	5.8 Ad
175519		984	13.4 L	984	10.8 An	023	8.4 Rc	001	5.8 Mn	023	5.8 Me
992	11.2 L	998	13.6 L	984	10.5 L	RY LYR		001	5.6 Si	023	5.9 Rc
005	10.0 Bw	007	14.0 L	996	9.5 L	184134		001	5.7 Mg	025	6.0 Rc
005	10.5 Pt	TV HER		998	9.7 B	006	13.6 L	001	5.3 Ko	034	5.9 Gy
006	9.9 L	181031		001	9.7 El	009	13.5 Ie	001	5.4 Rc	RW LYR	
012	9.7 L	992	10.5 L	005	9.8 Pt	R SCT		001	5.8 Pt	184243	
017	9.4 Me	006	10.3 L	005	10.0 Bw	*184205*		002	5.5 Pt	998	12.6 B
V DRA		011	10.6 L	006	9.5 L	952	5.3 Hr	002	5.3 Bc	NOV AQL	
175654		RY OPH		012	9.3 L	952	5.0 Sl	002	5.3 Cy	184300	
998	13.9 L	181103		017	10.1 Me	957	5.2 Sl	002	5.4 Hu	980	10.7 Jo
005	13.8 Pt	952	10.3 Sl	T SER		967	5.4 Cy	002	5.5 Wa	001	11.5 Pt
007	13.9 L	957	9.8 Sl	182306		972	5.5 Hr	003	5.5 Jo	003	11.1 Jo
		973	8.0 Sl	999	12.6 B	973	5.4 Sl	003	5.4 Ko	017	11.7 Pt

Variable Star Observations Received During November, 1932.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RX Lyr	Z Lyr	RX Sgr	U Dra	RY Sgr	R Cyg
185032	185634	*190918*	190967	*191033*	193449
984 12.8 L	984 14.0 L	012[12.4 B	003 12.9 Ie	012 7.0 L	984 8.7 Jo
998 13.0 L	003[13.0 Co	RW Sgr	005 12.8 Pt	014 6.7 Me	986 8.7 We
998 13.0 Me	005[13.8 Bw	*190819a*	007 12.7 L	016 6.6 Me	988 8.9 Ah
003 13.0 Co	006 13.8 L	953 10.8 Ht	W Aql	017 6.6 Me	989 8.6 Ko
003 13.1 Eb	SU Sgr	954 11.1 En	*191007*	017 6.4 Pt	999 7.0 Si
005 13.1 Pt	*185722*	974 10.3 En	991 12.1 L	019 6.7 Me	999 7.6 Me
007 13.1 L	953 8.5 Ht	974 10.5 Ht	999 11.8 Me	020 6.6 Me	001 8.2 We
R Lyr	974 8.5 Ht	979 10.3 Ht	005 12.0 Pt	021 6.6 Me	001 8.9 Mc
185243	979 8.6 Ht	991 9.6 L	006 12.2 L	TY Sgr	002 8.6 Me
983 4.1 Si	RT Lyr	005 9.0 Pt	T Sgr	*191124*	002 6.9 El
999 4.3 Si	185737	006 9.9 Me	*191017*	970 13.0 Bl	003 7.5 Jo
001 4.1 Si	984 11.2 L	007 9.7 L	005 12.2 Pt	975 13.0 Bl	003 7.9 Ko
001 4.4 Mc	986 9.5 We	TY Aql	R Sgr	S Sgr	003 7.8 Ah
006 4.4 Mc	998 11.3 L	*190907*	*191019*	*191319a*	005 7.1 Pt
008 4.3 Si	001 11.3 El	996 10.6 Me	953 8.0 Ht	954[12.7 Gy	005 7.2 B
008 4.3 Oy	007 11.7 L	997 10.3 Me	954 8.2 En	970[13.1 Bl	006 8.6 Mc
012 4.1 Mc	008 11.5 El	998 10.3 Me	974 7.6 En	974[12.7 Ht	008 7.0 Hf
014 4.1 Se	011 10.4 Jo	999 10.3 Me	974 7.5 Ht	000[13.5 L	008 6.8 El
016 4.1 Se	V Aql	000 10.5 Me	979 7.7 Ht	005[12.7 Pt	008 7.2 Wd
022 4.1 Se	*185905*	003 10.4 Me	983 7.7 Ko	Z Sgr	009 7.3 Sh
S CrA	953 7.8 Hr	004 10.3 Me	984 8.2 HS	*191321*	009 7.4 Wd
185437a	998 7.7 Mn	005 10.3 Me	986 7.8 We	954[12.2 En	009 7.3 Jo
952 12.0 Sl	001 7.8 Mn	005 10.3 Pt	991 7.8 L	984[13.3 L	009 7.6 Ad
953 12.1 Ht	007 7.8 Mn	006 10.3 Me	997 7.9 Me	010 12.0 L	012 8.3 Mc
954 12.0 En	011 7.8 Mn	007 10.2 Me	005 8.0 Pt	SW Sgr	013 6.4 Gy
957 12.2 Sl	R Aql	008 10.3 Me	008 8.3 Ko	*191331*	016 7.2 Wd
970 12.5 Bl	190108	010 10.5 Me	010 8.3 L	954[12.1 En	022 6.6 Wd
974 11.8 Ht	975 7.0 Rc	011 10.3 Me	013 8.5 B	970[12.9 Bl	023 6.9 Ad
974 12.0 En	980 7.0 Jo	012 10.3 Me	RY Sgr	TZ Cyg	024 6.5 Sh
975 12.0 Bl	982 7.4 Rc	014 10.3 Me	*191033*	191350	034 6.5 Gy
977 11.5 Sl	983 7.2 Si	016 10.3 Me	952 7.0 Sl	005 11.0 Pt	RV Aql
979 11.8 Ht	983 6.0 We	017 10.4 Me	953 6.7 Ht	U Lyr	193509
ST Sgr	984 7.3 Jo	019 10.3 Me	954 6.9 En	191637	002 13.8 L
185512a	985 7.4 Ah	020 10.6 Me	969 6.4 En	983 10.4 Jo	009 13.9 L
984 9.9 L	989 6.9 Ko	021 10.4 Me	970 7.0 Bl	005 10.4 Jo	T Pav
996 8.8 Me	995 7.7 Rc	022 10.8 Me	974 6.5 Ht	005 10.8 Pt	*193972*
998 8.6 L	998 7.4 Mn	S Lyr	974 6.3 En	017 10.8 Me	952 8.7 Ht
007 8.5 L	001 7.5 Mn	190925	975 6.9 Bl	AF Cyg	958 8.7 Sl
R CrA	001 7.5 Si	005[12.9 Pt	977 6.5 Sl	192745	969 8.6 Ht
185537a	003 7.5 Jo	007[13.8 L	979 6.5 Ht	985 7.5 Ah	970 8.7 Bl
952 13.3 Sl	003 7.0 B	X Lyr	981 6.7 En	988 7.7 Ah	975 8.8 Bl
954 12.5 En	003 7.4 Ko	190926	991 7.3 L	003 7.5 Ah	976 8.6 Ht
957 12.5 Sl	003 7.7 Ah	953 9.2 Hr	995 7.0 Pt	010 7.4 Ah	RT Cyg
970 12.0 Bl	004 7.6 We	005 9.0 Pt	996 7.3 L	TY Cyg	194048
974 11.4 En	005 7.2 Pt	RS Lyr	000 7.4 L	192928	980 12.0 Jo
974 11.7 Ht	007 7.4 Mn	190933a	001 7.2 Pt	984 13.8 L	984 12.4 Jo
975 12.5 Bl	009 8.0 Jo	998 10.7 L	002 7.0 Pt	002 14.0 L	999 12.1 Me
977 11.7 Sl	009 7.4 Ad	005 9.9 Pt	004 7.0 Me	011 13.8 L	001 9.6 We
T CrA	011 7.5 Mn	007 10.4 L	005 6.9 Me	RT Aql	002 12.2 El
185537b	020 8.1 Me	013 10.1 Gy	005 7.0 Pt	193311	003 12.5 Jo
952 12.9 Sl	V Lyr	034 10.4 Gy	006 7.2 L	991 11.8 L	005 12.2 Pt
954 12.8 En	190529a	RU Lyr	006 6.9 Me	002 12.3 B	008 12.4 El
957 13.0 Sl	005[12.3 Pt	190941	007 6.8 Me	003 12.2 Wa	009 12.2 Jo
970 13.0 Bl	RX Sgr	005[13.8 Pt	008 6.8 Me	005 12.4 Pt	013 11.9 Wa
974 12.0 Ht	*190818*	009[13.3 Mg	010 6.7 Me	006 12.8 L	015 11.9 Lg
974 12.5 En	954[11.8 En	U Dra	010 7.1 L	R Cyg	034 11.7 Gy
975 13.1 Bl	974[12.7 Ht	190967	011 6.6 Me	193449	
977 12.5 Sl	005 11.4 Pt	998 12.7 L	012 6.6 Me	980 8.7 Jo	

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
TU CYG	χ CYG	RS AQL	R CAP	RS CYG	RT SGR
194348	194632	*195308*	*200511*	200938	*201139*
980 9.6 Jo	007 5.9 Mg	986 9.6 We	991 11.4 L	980 7.8 Jo	970 13.2 Bl
984 10.3 Jo	007 5.4 Bg	991 11.0 L	998 11.4 B	982 8.9 Cy	975 13.0 Bl
984 10.3 L	008 5.7 Wd	005 11.6 B	005 11.3 Pt	982 8.2 Bf	WX CYG
987 10.3 Ry	008 5.7 Hf	006 11.4 L	006 11.7 L	982 8.2 Bc	201437b
994 10.3 Ry	009 5.7 Se	NOV CYG	S AQL	984 8.0 Jo	980 9.4 Jo
998 10.6 L	009 5.6 Wd	195553	200715a	987 8.1 L	982 10.7 Cy
999 10.6 Ry	009 5.6 Jo	001[12.2 Pt	980 10.0 Jo	988 8.5 HS	984 9.8 Jo
999 10.4 Me	009 5.7 Ad	013[13.2 Wa	983 9.8 We	989 8.9 Cy	987 10.7 L
002 10.7 Ry	009 5.6 Sh	RR TEL	984 9.4 An	999 8.1 Si	989 10.8 Cy
003 10.5 Jo	010 5.8 Ah	*195656*	985 9.6 Ah	002 9.0 Cy	002 10.8 Cy
005 12.4 Pt	010 5.6 Wd	952[12.6 Ht	987 9.6 Mg	002 8.2 Ko	002 11.3 L
007 10.8 Ry	010 5.5 Hf	974[12.6 En	998 9.4 Me	002 8.0 L	003 10.7 Jo
009 11.1 L	011 5.1 HS	979[12.6 Ht	003 9.5 Ah	003 8.3 Jo	003 11.2 Eb
009 11.0 Jo	013 5.2 Se	Z CYG	003 9.4 Jo	003 8.6 Me	003 10.9 Co
012 11.1 Ry	013 5.3 Gy	195849	005 9.4 Pt	005 8.3 Pt	005 11.1 Pt
015 11.1 Lg	014 5.2 Se	000 12.9 L	009 9.4 Jo	008 8.8 Wd	009 10.8 Jo
X AQL	014 5.2 Bg	003 12.7 B	010 9.6 Be	008 8.9 Hf	011 11.4 L
194606	014 5.3 HS	005 12.6 Pt	010 9.5 An	009 8.4 Jo	019 11.3 Me
980 9.5 Jo	014 5.2 Hu	009 13.0 L	012 9.8 B	009 8.8 HS	V SGE
984 9.7 Jo	015 5.1 Se	S TEL	014 9.6 Me	011 8.8 HS	201520
985 10.1 Ah	015 5.1 HS	*195855*	RW AQL	011 8.2 L	996 12.2 Me
991 10.5 L	016 5.1 Se	952 12.8 Ht	200715b	013 8.9 HS	997 12.0 Me
998 10.5 B	016 5.6 Wd	970 13.1 Bl	980 9.9 Jo	014 8.8 HS	998 11.9 Me
999 11.0 Hi	017 5.3 Wd	974 12.8 Ht	987 8.9 Mg	014 8.5 GD	999 11.5 Me
000 10.9 Hi	017 5.4 Hf	976 12.6 En	003 10.0 Jo	015 8.9 HS	000 11.6 Me
001 10.2 Mc	018 5.2 Bg	SY AQL	005 9.3 Pt	022 8.7 Wd	002 11.5 Me
002 10.2 Mc	020 5.2 Me	200212	009 9.7 Jo	R DEL	003 11.0 Me
003 10.8 Jo	022 5.2 Wd	982 9.3 Be	012 9.2 B	201008	004 11.3 Me
003 10.8 Ah	022 4.9 Se	982 9.4 An	R TEL	980 9.9 Cy	005 11.5 Me
003 11.0 Sf	023 4.9 Ad	987 9.5 L	*200717*	984 10.0 An	006 11.4 Me
005 11.0 Pt	024 5.1 Bg	000 9.6 L	970 8.5 Bl	986 10.0 We	007 11.6 Me
006 11.0 L	034 5.1 Gy	001 9.5 Wa	975 8.7 Bl	987 10.3 Mg	008 11.3 Me
007 11.0 Hi	036 5.4 Gy	003 9.4 My	976 8.6 En	987 10.1 L	010 11.0 Me
009 11.5 Jo	S PAV	005 9.9 Pt	RU AQL	988 10.1 Ah	011 11.0 Me
017 11.6 Me	*194650*	005 9.6 B	200812	989 10.3 Ko	012 11.0 Me
χ CYG	953 6.9 Sl	009 9.5 L	000 14.1 L	998 11.2 B	014 11.6 Me
194632	954 7.5 En	010 9.5 Be	001 13.8 B	002 11.1 Cy	015 11.3 Me
980 7.9 Jo	974 7.7 En	010 9.6 An	009 13.3 L	002 11.2 El	016 11.4 Me
984 7.7 Jo	RR SGR	017 9.8 Me	W CAP	002 10.7 L	017 11.3 Me
988 7.3 Ah	*194920*	S CYG	*200822*	003 9.8 Jo	019 11.3 Me
997 6.7 Me	925[12.2 En	200357	970 13.1 Bl	003 11.4 Ko	020 11.5 Me
997 6.6 Hu	970[13.2 Bl	996 10.1 Me	975 12.8 Bl	003 11.3 Sf	021 11.9 Me
000 6.2 Hu	RU SGR	999 10.4 Wr	005 12.1 Pt	005 11.6 Hl	022 11.7 Me
000 6.2 Bg	*195142*	000 10.5 Wr	Z AQL	005 11.3 Pt	U CYG
001 6.2 Si	940 12.6 En	002 9.4 Bc	*200906*	009 11.2 Cy	201647
001 6.3 Mg	946 12.5 En	002 10.5 El	984 12.8 An	009 10.2 Jo	980 8.9 Jo
001 6.2 Hu	951 12.1 En	003 10.0 Jo	998 11.9 B	011 11.2 L	983 10.1 Mn
002 5.8 Bc	953 12.1 Ht	003 9.9 B	002 11.5 Hi	017 11.9 El	984 9.3 Jo
002 6.0 Ko	970 10.2 Bl	005 10.0 Pt	005 11.6 Pt	019 11.9 B	985 10.2 Mn
002 6.0 El	974 9.7 Ht	008 10.4 El	R SGE	RT CAP	987 10.5 Ko
002 7.0 We	975 9.4 Bl	011 9.3 Jo	200916	*201121*	001 10.3 Mn
002 5.9 Bg	RR AQL	011 10.5 Wr	980 9.2 Jo	005 6.5 Pt	001 10.3 Mc
002 6.3 Hu	*195202*	013 10.5 Gy	998 8.7 Me	SX CYG	002 10.3 Mc
003 6.2 Jo	984 13.7 L	015 11.0 Lg	003 9.0 Jo	201130	002 10.8 Ko
003 6.1 Ah	002 13.7 L	034 11.3 Gy	009 9.2 Jo	003[13.1 Co	003 9.6 Jo
003 6.7 B	003 13.2 B	036 11.2 Gy	014 9.2 Me	005[13.1 Pt	003 11.0 Ah
005 5.9 Pt	011 13.7 L			016[13.1 Bw	005 9.2 Pt
006 7.0 We					008 10.5 Wd

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs.

U CYG
201647
008 10.8 Hf
009 9.9 Jo
012 10.3 Mc
019 9.5 Me
022 10.0 Wd
022 10.3 Eb
022 10.6 Co
U MIC
202240
970[13.6 Bl
RU CAP
202622
998[12.0 B
Z DEL
202817
998[13.0 B
000[13.9 L
005[12.9 Pt
007[13.1 Hi
ST CYG
202954
000 14.0 L
005 13.7 Pt
011 13.9 L
V VUL
203226
005 8.8 Pt
R MIC
203429
970 10.3 Bl
975 11.0 Bl
Y DEL
203611
000 13.8 L
009 13.9 L
S DEL
203816
980 9.5 Jo
987 9.6 Mg
997 9.5 Hu
001 8.9 Wa
002 9.8 Hu
003 8.9 Jo
005 9.1 Pt
008 9.2 Me
009 8.9 Sz
010 9.3 Ah
013 8.9 B
014 9.3 Hu
V CYG
203847
980 11.9 Jo
000 13.5 L
003 11.8 Jo
009 13.5 L
022 12.0 Co
022 12.0 Eb

J.D.Est.Obs.

Y AQR
203905
984[13.3 An
003 13.5 B
011[12.5 Jo
T DEL
204016
982 12.7 Cy
982 12.9 Be
982 12.8 An
987 12.4 L
001 11.5 B
002 11.3 Cy
002 11.3 L
005 11.5 Pt
009 11.0 Cy
010 11.0 Be
010 11.0 An
011 10.8 L
012 10.9 Me
019 9.7 B
V AQR
204102
992 8.7 L
005 8.2 Pt
006 8.5 L
012 9.2 Me
013 8.7 B
W AQR
204104
983 12.5 Cy
987 12.6 L
002 12.6 Cy
002 12.4 L
003 13.6 B
007 13.3 Hi
011 13.5 L
U CAP
204215
970 11.6 Bl
975 11.1 Bl
987 11.2 L
000 11.5 L
002 12.0 B
009 11.9 L
V DEL
204318
987[14.4 Mg
T AQR
204405
980 9.0 Jo
984 8.7 Jo
984 8.8 An
987 8.9 Mg
988 9.0 Ah
996 8.5 Me
999 8.5 Si
000 8.0 Fq
001 8.0 Mn
001 8.7 Si

J.D.Est.Obs.

T AQR
204405
001 8.6 Hc
003 8.0 Jo
003 8.3 Ah
005 7.8 We
005 7.7 Pt
010 7.8 Ah
011 7.8 Jo
011 8.0 Mn
011 7.8 Fq
013 7.6 B
RZ CYG
204846
005 13.0 Pt
S IND
204954
952 11.8 Ht
970 9.5 Bl
974 9.6 Ht
975 9.3 Bl
979 9.1 Ht
X DEL
205017
987 12.4 L
002 13.6 L
005 14.1 Pt
011 14.4 L
UX CYG
205030a
008[13.5 Me
R VUL
205923a
980 11.0 Jo
984 10.5 Jo
988 9.9 Ah
002 8.4 Hu
003 8.4 Jo
003 8.6 Ah
003 8.4 My
005 8.0 Pt
007 8.1 Me
009 8.1 Jo
010 8.3 Ah
014 8.3 Hu
V CAP
210124
970[13.2 Bl
002 14.0 L
TW CYG
210129
000 13.5 L
009 14.0 L
X CAP
210221
970 11.4 Bl
975 11.4 Bl
005 12.6 Pt

J.D.Est.Obs.

RS AQR
210504
987 11.0 Mg
987 11.0 L
002 11.5 L
003 12.0 B
005 12.0 Pt
011 12.2 L
Z CAP
210516
987 10.7 L
000 11.7 L
002 11.6 B
005 12.0 Pt
009 12.4 L
R EQU
210812
987 12.0 L
002 10.2 L
002 10.5 BL
005 10.0 Pt
009 10.6 BL
011 9.9 L
026 9.2 BL
T CEP
210868
980 7.3 Jo
983 8.5 Si
983 8.4 Mn
985 8.3 Mn
988 8.0 Ah
989 7.5 Jo
998 8.3 Mn
001 8.2 Mn
001 7.3 Fq
002 7.5 Ko
003 7.3 Jo
003 8.1 Ah
004 7.4 El
004 8.2 We
005 8.1 Mn
007 8.2 Mn
007 7.8 Me
008 8.0 Wd
008 7.9 Hf
009 6.0 Jo
009 7.7 Pt
011 8.0 Mn
011 7.7 Fq
013 7.2 Sh
014 7.5 Hu
016 8.0 Wd
017 7.1 El
RR AQR
210903
984 11.6 An
987 11.7 Mg
991 12.1 L
002 12.9 L
003 13.3 B

J.D.Est.Obs.

RR AQR
210903
005 12.9 Bw
009 12.8 Pt
011 13.9 L
Y PAV
211570
952 5.8 Ht
969 5.6 Ht
976 5.4 Ht
X PEG
211614
991 10.0 L
002 10.0 L
009 10.9 Pt
011 10.9 L
T CAP
211615
970 12.5 Bl
975 13.1 Bl
987 13.4 Mg
002 13.3 L
011 13.2 L
S MIC
212030
970 13.0 Bl
975 13.4 Bl
981[12.4 En
Y CAP
212814
987 13.5 Mg
002 13.8 B
002 14.1 L
011 13.0 L
W CYG
213244
983 6.2 Si
987 6.5 L
999 6.5 L
999 6.7 Si
001 6.2 Si
008 6.2 Oy
009 6.1 L
S CEP
213678
981 11.2 Cy
987 10.7 Mg
988 11.1 Cy
000 10.5 Wr
001 10.2 Mg
002 10.1 Cy
003 9.7 Wa
003 9.7 Mc
009 9.8 Pt
009 10.1 Cy
011 10.5 Wr
RU CYG
213753
980 7.9 Jo
981 8.0 Cy

J.D.Est.Obs.

RU CYG
213753
984 8.2 Jo
987 8.2 Ry
988 8.6 Ah
988 8.3 Cy
989 8.2 Jo
994 8.3 Ry
999 8.6 Ry
002 8.6 Cy
002 8.7 Ry
003 8.4 Jo
003 8.6 Ah
005 9.0 Me
007 9.0 Ry
009 8.5 Pt
009 8.7 Cy
011 8.6 Jo
012 9.0 Ry
RV CYG
213937
009 6.5 Pt
RR PEG
214024
001[14.1 Mg
009[13.0 Pt
R GRU
214247
970 13.1 Bl
976 12.9 En
979 12.6 Ht
981 12.6 En
V PEG
215605
991 9.5 L
006 10.5 L
009 10.0 Wa
009 10.1 Pt
012 10.5 L
013 10.4 Wa
U PSA
215628
976[12.2 En
U AQR
215717
002 11.2 L
009 11.3 Pt
011 11.2 L
012 11.7 B
S PSA
215828
976[12.2 En
RY PEG
220133a
005 12.7 Bw
009 12.0 Pt
013 12.8 Bw
RZ PEG
220133b
998 12.0 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RZ PEG	S LAC	V CAS	Z AND	R AQR	V CET
220133b	*222439*	230759	*232848*	*233815*	*235209*
005 12.3 Bw	002 11.1 El	002 10.4 Cy	980 10.8 Cy	988 8.3 Jo	970[13.0 Bl
010 12.2 L	003 10.5 Wr	002 10.2 B	983 10.6 Cy	988 8.4 Bc	001 14.1 Mg
013 12.4 Bw	008 10.7 El	003 10.9 Ko	983 10.8 Jo	989 8.5 Ko	R TUC
T PEG	009 11.3 Cy	003 10.7 Ah	988 10.6 Jo	998 8.4 Bc	*235265*
220412	009 11.5 BL	004 10.9 El	989 10.7 Ko	999 7.7 Si	952[13.5 Ht
999[13.3 L	009 11.1 Pt	005 10.6 Jo	990 10.6 Cy	000 8.7 Fq	974[13.5 Ht
002[13.8 Hi	010 10.8 L	005 11.2 Me	002 10.3 Cy	000 8.5 L	981[12.9 En
009 14.4 L	011 10.8 Ko	008 10.8 We	003 10.4 Ko	000 8.3 We	R CAS
013[13.8 Bw	026 10.2 BL	009 11.0 Pt	005 10.6 Hl	001 8.4 Mn	235350
Y PEG	R IND	009 11.0 Cy	008 10.8 Cy	001 8.4 Si	983 9.7 Mn
220613	*222867*	017 11.1 El	009 10.7 Pt	001 8.7 Hc	983 10.0 Jo
001[13.7 Mg	952[13.5 Ht	019 11.1 B	011 10.2 Cy	001 8.4 Mg	985 10.2 Jo
009[12.5 Pt	970[13.0 Bl	W PEG	013 10.8 Bw	002 8.4 Bc	985 9.6 Mn
RS PEG	976[12.0 En	231425	014 10.4 Wa	002 8.7 Ko	988 10.2 Ah
220714	T TUC	980 11.2 Cy	ST AND	002 8.4 Wa	998 10.0 Mn
991 9.2 L	*223462*	983 11.0 Jo	*233335*	003 8.5 Jo	001 10.1 Mn
001 9.5 Mg	952 9.4 Ht	988 11.3 Cy	979 11.4 BL	003 8.5 Me	002 10.2 B
002 9.1 L	974 10.6 Ht	989 11.1 Jo	983 11.4 Cy	005 8.3 We	007 10.1 Mn
009 9.5 Pt	976 10.7 En	991 11.5 L	983 10.4 Jo	008 8.4 Ko	011 10.3 Mn
011 9.5 L	979 10.9 Ht	001 11.9 Mg	988 10.2 Jo	009 8.5 Pt	016 10.4 Wd
R PSA	981 10.5 En	003 11.2 Cy	989 11.2 BL	010 8.3 L	Z PEG
221230	R LAC	003 11.3 Jo	990 10.6 Cy	011 8.1 Jo	235525
976[12.0 En	223841	005 12.3 Bw	999 10.2 My	011 8.2 Fq	000 12.1 L
T GRU	006 14.4 L	006 12.0 L	001 10.7 Mg	Z CAS	009 10.5 Pt
221938	RW PEG	011 11.9 Cy	002 10.6 Cy	*233956*	010 11.6 L
976 11.0 En	225914	013 12.4 Bw	002 10.3 Jo	983 9.4 Jo	013 11.7 Gy
S GRU	002 13.8 L	S PEG	002 11.0 BL	985 9.6 Jo	014 11.5 Wa
221948	009 10.6 Sz	231508	008 10.0 Lg	991 10.0 L	034 10.5 Gy
952 6.0 Ht	011 13.7 L	980 10.8 Cy	009 10.4 Cy	001 10.2 Mg	W CET
956 6.2 En	R PEG	988 10.7 Cy	009 10.6 BL	001 10.4 B	*235715*
957 6.2 En	230110	991 12.0 L	009 10.2 Pt	004 10.6 L	983 7.8 Si
965 6.2 En	985 8.6 Ah	999 10.4 Wr	010 10.3 My	007 10.6 We	002 11.0 Ko
969 6.5 En	001 9.1 Mg	000 10.6 Wr	012 10.4 B	014 10.6 Wa	003 10.6 Wr
972 6.3 Ht	003 9.1 Ah	001 10.4 Mg	026 10.1 BL	015 10.7 Bw	008 11.0 Ko
976 7.0 En	003 9.2 Sf	003 9.8 Cy	R AQR	RR CAS	Y CAS
979 6.9 Ht	007 9.0 Me	006 10.2 L	*233815*	235053	235855
981 7.0 En	008 9.3 Wd	009 9.7 Pt	952 7.9 Ht	980 11.5 Jo	000 13.8 L
RV PEG	008 9.1 Hf	010 9.9 Hf	962 8.3 Bl	982 11.0 Bn	001 13.7 B
222129	009 9.3 Sf	010 9.9 Wd	970 8.3 Bl	985 10.6 Jo	010 14.0 L
009 14.2 L	009 9.5 Pt	011 9.4 Cy	972 7.9 Ht	986 10.9 Bn	SV AND
S LAC	014 9.1 GD	011 9.7 Wr	975 8.4 Bl	999 10.9 Bn	235939
222439	029 9.6 My	V PHE	977 8.3 En	002 10.6 B	983 11.7 Cy
979 12.1 BL	V CAS	*232746*	979 8.0 Ht	005 10.9 Bn	990 11.7 Cy
988 11.8 Cy	230759	952 9.6 Ht	980 8.4 Jo	007 11.3 We	002 11.1 Cy
999 12.2 L	983 9.4 Si	974 10.5 Ht	982 8.1 Bc	R PHE	009 10.6 Cy
001 11.1 Mg	983 9.5 Cy	976 10.2 En	982 8.5 Be	*235150*	009 10.4 Pt
001 11.9 Ko	983 9.0 Jo	979 10.6 Ht	982 8.4 An	958[12.7 Sl	012 10.5 B
002 11.4 Cy	988 9.8 Ah	981 10.3 En	983 8.1 Si	977[12.7 En	015 10.8 Bw
002 11.6 BL	989 9.8 Ko		984 8.0 We		
	990 9.8 Cy		987 8.6 L		

RAPIDLY VARYING IRREGULAR VARIABLES.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX ANDROMEDAE—					005840 RX ANDROMEDAE—				
	6983.6	12.3 Ko	6987.5	11.1 Ry		6988.6	11.1 Ko	6991.4	11.6 Ry
	6984.6	11.6 Ko	6987.6	11.5 Ko		6989.6	11.1 Ko	6998.6	13.5 Me

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX ANDROMEDAE—						
	6999.6	13.5	Me	7008.6	11.9	Me
	7000.6	12.4	Me	7008.6	11.7	Ko
	7000.8	12.5	Me	7009.6	12.2	Ko
	7001.6	11.9	Ko	7009.7	12.0	Pt
	7001.7	11.4	Pt	7010.6	12.7	Me
	7002.5	11.8	Ry	7011.6	13.0	Me
	7002.6	12.0	Ko	7012.6	13.2	Me
	7002.7	11.8	Pt	7012.6	12.8	Ry
	7002.8	11.7	Me	7013.6	11.4	Gy
	7003.6	11.8	Me	7014.7	11.5	Me
	7003.6	11.5	Ko	7015.7	11.5	Pt
	7004.6	11.4	Me	7015.8	11.2	Me
	7004.8	11.5	Pt	7016.8	11.7	Me
	7005.6	11.3	Me	7017.6	12.1	Me
	7005.7	11.5	Pt	7020.6	12.8	Me
	7006.6	11.5	Me	7021.6	11.8	Me
	7007.6	11.6	Ry	7034.7	11.4	Gy
	7007.6	11.6	Me	7036.6	11.6	Gy
	7007.8	11.5	Pt			
060547 SS AURIGAE—						
	6979.4	12.9	Ry	7005.7	12.5	Jo
	6980.6	10.7	Cy	7006.4	13.9	L
	6981.9	11.1	Cy	7007.3	13.9	L
	6982.7	11.6	Cy	7008.7	12.5	El
	6983.7	11.8	Cy	7009.6	12.6	Wa
	6984.4	12.2	L	7010.7	14.4	L
	6986.4	12.5	L	7011.7	13.9	L
	6987.5	12.5	Ry	7012.5	12.5	Ry
	6988.8	12.5	Cy	7013.6	12.4	Gy
	6990.9	12.5	Cy	7014.6	13.0	Wa
	6991.4	11.5	Ry	7015.6	14.5	Lg
	6994.5	12.5	Ry	7016.7	13.8	Bw
	7001.7	12.5	Pt	7017.8	13.8	El
	7002.8	12.8	Me	7034.6	11.8	Gy
	7003.7	12.6	Wa	7036.6	12.4	Gy
	7004.8	12.5	Pt			
074922 U GEMINORUM—						
	6981.9	12.4	Cy	7007.8	12.4	Pt
	6983.8	12.4	Cy	7009.7	14.0	L
	6984.6	12.4	L	7010.6	14.1	L
	6988.8	12.4	Cy	7011.7	14.0	L
	6990.9	12.4	Cy	7015.6	13.8	Lg
	6997.7	13.3	L	7017.7	13.3	Pt
	7002.7	10.0	L	7023.0	14.0	Me
	7004.7	13.3	L	7034.7	12.4	Gy
	7006.7	13.8	L	7036.7	12.4	Gy
081473 Z CAMELOPARDALIS—						
	6980.8	12.7	Cy	6998.2	11.6	L
	6981.9	12.7	Cy	6998.6	12.2	Me
	6982.4	12.9	An	6999.3	12.4	L
	6982.4	12.8	Be	6999.6	12.2	Me
	6984.3	12.7	An	7000.3	12.8	L
	6984.3	13.1	L	7000.6	12.4	Me
	6987.4	12.5	L	7001.7	12.1	Pt
	6988.8	12.7	Cy	7002.4	12.1	L
	6991.2	10.3	L	7002.6	11.6	Ko
	6992.2	10.3	L	7002.7	11.6	Cy
	6997.6	12.0	Me	7002.7	11.9	Pt
081473 Z CAMELOPARDALIS—						
	7002.8	11.5	Me	7010.6	12.1	Me
	7003.6	11.4	Ko	7010.7	12.1	L
	7003.6	11.5	Me	7011.3	12.3	L
	7004.6	11.4	Me	7011.6	12.2	Me
	7004.6	11.7	L	7011.7	12.3	L
	7004.8	11.5	Pt	7012.2	12.2	L
	7005.6	11.6	Me	7012.6	12.1	Me
	7005.7	11.6	Pt	7013.7	11.8	Gy
	7006.3	11.2	L	7014.7	11.7	Me
	7006.6	11.6	Me	7015.7	12.6	Pt
	7006.7	11.7	L	7015.8	11.5	Me
	7007.3	11.6	L	7016.6	11.4	Me
	7007.6	11.6	Me	7017.6	11.5	Me
	7007.8	11.2	Pt	7017.7	12.4	Pt
	7008.6	11.8	Me	7019.6	11.4	Me
	7008.6	11.4	Ko	7020.6	11.6	Me
	7009.6	11.8	Ko	7021.6	12.1	Me
	7009.7	12.2	L	7023.0	12.1	Me
	7009.7	11.9	Pt	7034.6	11.1	Gy
	7009.8	12.1	Cy	7036.6	11.5	Gy
094512 X LEONIS—						
	7015.9	12.9	Pt	7017.9	12.2	Pt
202946 SZ CYGNI—						
	6995.7	9.8	Pt	7007.8	9.2	Pt
	7001.7	9.2	Pt	7009.7	9.5	Pt
	7002.7	9.1	Pt	7015.7	9.2	Pt
	7004.8	9.0	Pt	7017.7	9.2	Pt
	7005.7	8.9	Pt			
213843 SS CYGNI—						
	6950.2	11.8	Hr	6988.5	12.0	Ah
	6952.9	11.8	Hr	6988.6	11.8	Bc
	6959.0	11.8	Hr	6988.6	11.8	Jo
	6972.9	11.9	Hr	6988.6	11.7	Ko
	6979.6	11.7	Cy	6988.7	11.6	Cy
	6980.6	11.3	Cy	6989.6	11.7	Cy
	6980.6	11.9	Jo	6989.6	11.9	Ko
	6981.9	11.5	Hr	6989.8	11.9	Jo
	6981.9	11.3	Cy	6991.2	11.5	L
	6982.3	12.0	Be	6991.6	11.8	Jo
	6982.3	11.2	An	6992.2	11.4	L
	6982.7	11.8	Bf	6995.7	11.7	Pt
	6982.7	11.8	Bc	6996.2	11.5	L
	6982.7	11.7	Cy	6996.6	11.1	Me
	6983.6	11.8	Jo	6997.6	8.6	Me
	6983.6	11.7	Ko	6997.6	8.8	Jo
	6983.7	11.7	Cy	6997.7	8.4	Hu
	6984.2	11.3	An	6998.2	8.3	L
	6984.4	11.9	L	6998.5	8.2	My
	6984.6	11.6	Mg	6998.6	8.5	Bf
	6984.6	11.7	Ko	6998.6	8.4	Bc
	6984.7	11.7	Jo	6998.6	8.3	Mg
	6985.1	11.8	Hr	6998.6	8.1	Me
	6985.6	11.8	Jo	6999.2	8.1	L
	6985.9	11.8	Hr	6999.5	8.3	My
	6987.3	12.0	L	6999.6	8.1	Me
	6987.6	11.5	Mg	7000.3	8.3	L
	6987.6	11.5	Ko	7000.6	8.1	Mg
	6988.1	11.7	Hr	7000.6	8.2	Me

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
213843 SS CYGNI—							213843 SS CYGNI—						
	7000.7	8.2	Hu	7004.6	8.6	Jo		7009.5	8.7	Sh	7011.8	9.2	Jo
	7000.7	8.1	We	7004.6	8.2	El		7009.6	8.6	Wd	7012.2	9.2	L
	7001.5	8.2	Wa	7004.7	8.3	We		7009.6	8.6	Cy	7012.6	9.4	Me
	7001.6	8.1	Mg	7004.8	8.4	Pt		7009.6	8.6	Mg	7013.5	10.2	HS
	7001.6	8.3	Ko	7005.6	8.7	Jo		7009.6	8.7	Jo	7013.6	9.5	Wa
	7001.7	7.8	We	7005.6	8.6	B		7009.6	8.7	Ko	7013.6	9.8	Sf
	7001.7	8.6	Hu	7005.6	8.5	Me		7009.6	8.5	HS	7014.5	10.9	HS
	7001.7	8.3	Pt	7005.7	8.4	We		7009.6	8.7	Wa	7014.6	10.0	Wa
	7002.2	8.3	L	7005.7	8.1	Hl		7009.6	8.4	Sf	7014.6	10.3	Hu
	7002.6	8.1	Wa	7005.7	8.4	Pt		7009.6	8.7	Sz	7014.7	10.0	Me
	7002.6	8.1	Cy	7006.2	8.3	L		7009.7	8.6	Pt	7015.6	10.6	Lg
	7002.6	8.5	Jo	7006.6	8.5	Me		7009.7	8.5	We	7015.6	10.5	Wa
	7002.6	8.3	Ko	7006.7	8.4	We		7010.2	8.8	L	7015.7	10.8	Pt
	7002.6	8.2	El	7007.2	8.7	L		7010.2	8.6	Be	7015.7	10.6	El
	7002.6	8.4	Bc	7007.5	8.6	El		7010.2	8.4	An	7015.8	10.9	Me
	7002.7	8.2	Pt	7007.6	8.5	Me		7010.3	8.9	Ah	7016.6	11.3	Me
	7002.7	8.3	We	7007.7	8.1	Hu		7010.6	8.9	Wa	7016.6	11.1	Wd
	7002.7	8.4	Hu	7007.8	8.7	Pt		7010.6	8.6	My	7017.6	11.6	Wd
	7002.8	8.4	Me	7008.5	8.8	Wa		7010.7	8.9	Me	7017.7	11.6	Me
	7003.3	8.4	Ah	7008.5	8.5	Sf		7010.6	9.0	Cy	7017.7	11.5	Pt
	7003.6	8.3	My	7008.5	8.5	El		7010.6	8.9	Ko	7019.6	11.8	Me
	7003.6	8.2	Wa	7008.6	8.4	Wd		7010.7	8.9	Wd	7020.6	11.7	Me
	7003.6	8.1	Sf	7008.6	8.9	Cy		7010.7	9.0	Hf	7020.6	11.9	My
	7003.6	8.4	Ko	7008.6	8.5	Hf		7011.2	8.9	L	7021.6	11.6	Me
	7003.7	8.2	Cy	7008.6	8.8	Ko		7011.5	9.6	HS	7022.6	11.8	Me
	7003.7	8.5	Me	7008.7	8.7	Me		7011.5	8.9	Wa	7022.6	11.9	Eb
	7003.8	8.6	Jo	7008.7	8.5	Mg		7011.6	9.1	L	7022.6	12.0	Co
	7004.5	8.6	Ah	7008.7	8.5	We		7011.6	9.2	Ko	7026.6	12.0	My
	7004.6	8.3	L	7008.7	8.9	Hu		7011.6	9.1	Me	7029.5	11.9	My
	7004.6	8.6	Me	7009.3	8.7	L		7011.7	9.1	Cy			

MONTHLY SUMMARY FOR NOVEMBER, 1932.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	47	90	Hildom, L.	Hl	9	9
Aldwell	Ad	5	8	Houghton	Ht	65	159
Ancarani	An	23	30	Houston	Hu	12	28
Baldwin	Bl	91	173	Hurahata	Hr	8	30
Benini	Be	13	20	Iedema	Ie	2	2
Bigelow	Bw	18	23	Jones	Jo	117	371
Boutell	BL	17	40	Kohman	Ko	43	104
Bouton	B	72	78	Lacchini	L	160	395
Brown, A. N.	Bn	3	9	Logan	Lg	12	13
Buckstaff, E.M.	Bf	3	5	McKnelly	My	11	19
Buckstaff, R.N.	Bc	7	17	McLeod	Mc	17	50
Bunting	Bg	2	7	Meek	Me	107	326
Cilley	Cy	43	139	Mennella	Mn	17	65
Cole	Co	8	8	Monnig	Mg	31	42
Ebert	Eb	6	6	O'Byrne	Oy	5	7
Eliason	El	38	71	Peltier	Pt	110	286
Ensor	En	73	142	deRoy	Ry	7	32
Godfrey Club	GD	5	7	Schenkman	Se	4	14
Gregory	Gy	33	65	Shinkfield	Sl	35	61
Haas	HS	11	35	Shultz	Sz	9	9
Hartmann	Hf	19	22	Simpson	Si	21	40
Hickerson	Hc	3	4	Smith, F. P.	Sg	4	8
Hildom, A.	Hi	12	14	Smith, F. W.	Sf	8	16

VARIABLE STAR OBSERVATIONS RECEIVED DURING NOVEMBER, 1932.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Smith, L.	Sh	7	8	Wetherbee	We	48	73
Theile	Th	3	4	Wright	Wr	9	14
Recinsky	Rc	5	27	Vorhies	Vh	1	1
Watson	Wa	20	38				
Webb	Wd	25	47	Totals	54	429	3313

Contributors to the Godfrey Club report are Messrs. Brennan, Bussewitz, Gaebler, Kuenzi, and Yeomans.

S Apodis, 14597*1*, is well on the rise to maximum after a period of 500 days when it was below the tenth magnitude, and, for nearly 150 days, below the fourteenth. Now we may expect R Coronae Borealis to start fading, with the other variables of this same type having recently passed through periods of minima.

LEON CAMPBELL, *Recorder.*

December 12, 1932.

Meteor Notes from the American Meteor Society

By CHARLES P. OLIVIER, President

To the date of writing, reports on the Leonids have arrived from correspondents in 27 states, and indirectly from persons in 3 others; from observers in Hawaii, India, New Zealand, Canada, and the Argentine Republic; and finally from a few ships at sea. We are thus able to form a fairly complete idea of the richness of the Leonid stream at its latest appearance, at least so far as observations of North America can give it.

While the table must be consulted for details, a general summary can be made here. First, moonlight everywhere and bad weather in very many places greatly hampered observations. Those who were favored with perfectly clear skies were few; most of us suffered more rather than less from clouds. The nearly full Moon cut out all chances of seeing the fainter meteors. Nevertheless, on the night of November 15-16, for observers favorably placed, the number of Leonids was considerable, at several stations the rate for one observer rising to from 30 to 50 per hour. Uninstructed observers, who did not report directly to us, in some places give even a higher rate. It would therefore seem that, making due allowance for the moonlight, the hourly rate in 1932 was comparable to that in 1931; but by no stretch of the imagination could we claim that a "great shower" appeared. In fact, the numbers were not a tenth as great as we had some reasons to expect. Only at Seattle, Washington, fragmentary reports would tend to the belief that the numbers were really considerable.

In view of these facts, what are the prospects for 1933? Frankly, not as good as calculations had seemed to indicate for 1932; but there are comforting points to remember. While it is *assumed* that the period of the Leonids is about 33 years, there is no certainty that it is constant. We know that Halley's Comet has changed the length of its period by 4 or 5 years. Historically, we find some intervals between maxima of the Leonids greater than usual: for instance, 1566 to 1602, 1799 to 1833. It is surely not impossible that we may have good fortune again, and a really fine shower in 1933. At any rate, nearly all of our observers of this year are showing good sportsmanship and expressing eagerness to try again next November.

While clouds ruined elaborate plans for duplicate observations by many of our members and others, some success, we know, was achieved by coöperating parties in Arizona, Florida, Texas, and Tennessee-Kentucky, in addition to our local network. At many other places, observers at one end of the base-line had some success, those at the other, none. So far as possible, the successful coöperating parties will undertake the calculation of their own data, thus showing their further interest in the work. Because of this, no more details of their observations will here be given.

The local network, working under special plans by the writer, as finally constituted included 14 stations stretching from New York City at the northeast end to King George, Virginia, at the southwest end. In addition to those two extreme stations, we had 2 in New Jersey, 3 in Pennsylvania, 4 in Maryland, and 3 in the District of Columbia. Two in the District were manned from the Naval Observatory staff; the other was at Georgetown College Observatory. In Maryland, Hood College Observatory at Frederick and the Observatory of the Maryland Academy of Sciences at Baltimore took part; the third party was at Mr. J. L. Woods' private observatory at Sykesville, and the fourth was at McDaniel, manned by two members of the Flower Observatory staff. The Flower Observatory itself and a station a short distance out in the country, manned by its staff, accounted for two in Pennsylvania, the third being at York. The New Jersey stations were at New Brunswick and Plainfield. Work was attempted at most stations on the three most likely nights. At the Naval and Flower Observatories, observing was also done on November 17-18.

From these 14 stations, 1847 meteors were recorded, and 80% of them mapped, for the three nights. It will be the work of months to compute the full results. The two best fireballs, leaving trains enduring at least 4 minutes, were observed by 9 or 10 of the 14 stations. Heights for these are partially derived, and train drifts will be computed. Mr. Woods at Sykesville got a photographic plate of one of these trains with 9 ten-second exposures at intervals of ten seconds. The writer knows of no similar feat. The number of heights depending upon observations at two stations will be very large; many of these can be checked by those from a third and some from even more stations. Of course it is quite impossible to discuss the accuracy of the probable results in advance, but the writer feels justified in saying that, to his knowledge, never before have 14 active stations, all in the same network and all working under the same instructions, taken part in such a coöperative program. The results which seem to be in sight fully justify the undertaking.

Its very possibility, however, was due to the generous coöperation of the directors and staffs of the observatories mentioned, as well as all the other observers, some members of the A.M.S. but most volunteers, who gave their time enthusiastically for the furtherance of the campaign. To each and all the writer expresses hearty thanks and appreciation, and wishes to add that when the results appear, they are the common property of all who took part, and each will be entitled to whatever credit there may be.

It may be added that the scarcity of the meteors prevented the success of several elaborate plans for using photography, Mr. Woods alone securing a plate of exceptional interest. Next year, with the Moon absent, photography should be tried as fully as possible with far greater prospects of success.

Name and Station	Nov.	Began	Ended	Total	Met.	Fac.	Rem.
A. Boyles, W. G. Montgomery, Ensley, Alabama	14	14:10	15:25	75	10	0.3	1, 2
Miss L. Harmon, F. B. Eason, Pell City, Alabama	13	11:00	14:15	195	6	0.4	3
	14	10:45	17:00	375	12	0.4	3
	15	11:00	14:30	210	12	0.2	3
W. S. Anderson, Cmdg. Off.,	15	13:08	16:52	224	45	...	3?
U.S.S. West Va., San Pedro, California	16	14:04	17:49	225	37	...	3?
G. W. Ridley,	16	14:00	18:00	240	61	0.2	
San Francisco, Calif.	17	16:20	17:45	85	8	0.4	
W. T. Whitney, Pomona	12	11:00	16:00	300	11	0.4	3, 4, 5
College, Claremont,	13	11:00	16:00	300	7	0.4	3, 4, 6
California	14	11:00	17:00	360	74	0.4	3, 4, 7
	15	11:00	17:00	360	102	0.1	3, 4, 8
	16	11:00	17:47	407	234	0.4	3, 4, 9
	17	12:00	17:30	330	52	0.4	3, 4, 10
	18	11:00	17:00	360	49	0.4	3, 4, 11
	19	12:00	16:00	240	14	0.4	3, 4, 12
A. M. Hannon, Carmel, Calif.	Casuals, Nov. 11-19				29		
W. R. Stone,	15	13:30	16:00	150	16	0.1	13
Santa Barbara,	16	12:45	16:00	195	15	0.4	13
California	17	12:00	15:00	180	8	0.4	13
A. Wade,	15	15:34	17:40	126	10	0.1	13
Los Angeles, California	16	16:10	17:35	85	21	...	13
C. A. Purdy, Lodi, California	16	13:00	14:15	75	3	0.2	
Rev. Y. O. Waln,	14	14:00	16:00	120	21	0.4	1
Niantic,	15	12:50	14:00	70	35	0.1	1
Connecticut	17	12:40	13:10	30	1	0.4	1
C. Haughton, Jr., Orlando, Fla.	16	13:20	14:20	60	5	...	1
Rev. R. G. Harbutt, St. Petersburg, Florida	16	13:45	17:00	195	14	0.1	1
Wm. L. Holt, Portland, Maine	15	13:10	17:48	278	140	0.4	4, 14
Miss C. Greene,	14	11:00	12:56	116	5	...	4
Boston, Massachusetts	15	13:05	15:10	125	17	...	4
P. F. Robinson,	14	14:00	15:30	90	5	0.4	4
Boston, Massachusetts	15	15:30	17:30	120	34	0.4	4
L. A. Brigham, Boston Univ. Men's party, Weston, Mass.	15	11:30	16:30	300	252	0.2	4, 15
Women's party, Waltham, Mass.	15	11:30	17:30	360	417	0.3	4, 16
E. A. Young, Medfield, Mass.	15	12:30	13:30	60	23	0.4	4
Smith College Observatory, Northampton, Mass.	15	14:00	16:00	120	98	0.4	4, 17
J. H. Darling,	14	13:00	15:00	120	3	0.4	4, 18
Duluth, Minnesota	15	13:00	15:00	120	13	0.2	4, 18
E. F. Bowman,	15	12:25	14:10	105	5	0.4	19
Kansas City, Missouri	16	15:44	18:04	140	7	<0.1	4
	17	12:30	16:00	210	8	0.3	4, 20
S. L. O'Byrne,	16	17:00	17:55	55	10	0.1	4, 18
Allenton, Missouri	17	13:00	14:02	62	8	0.3	4, 21
A. Aldeghi,	14	12:00	15:00	180	14	0.4	4, 22
Merchantville, New Jersey	15	12:00	14:45	165	46	0.2	4, 23
A. Schenkman, New Market, N.J.	15	13:31	14:59	88	8	<0.1	
D. Molyneaux, Binghamton, N.Y.	15	13:00	13:45	45	4	<0.1	
Mrs. W. S. Cary, Bradley, N.Y.	15	15:00	17:00	120	28	0.4	4
J. A. Kingsbury & party, N.Y.	15				901	0.4	4, 24
A. F. Ford, W. L. Favrao, Hamilton, New York	15	14:45	16:00	75	68	0.3	4, 25
J. G. Woodruff, J. C. Blanchard, N. T. Leavitt, Hamilton, N.Y.	15	14:45	16:00	75	9	0.2	25

Name and Station	Nov.	Began	Ended	Total	Met.	Fac.	Rem.
J. S. Allen, D. W. Trainer, F. W. Volckman, Hamilton, N.Y.	15	14:45	16:00	75	18	0.2	25
J. E. Merrill, Buffalo, N.Y.	15	15:00	15:30	30	4	<0.1	3
W. C. Ormond, Raleigh, N. C.	16	13:00	14:00	60	5	<0.1	
J. C. Swanson, Durham, N. C.	15	12:00	17:45	345	315	0.4	4, 26
R. Kuntz, Lawton, Okla.	15	14:30	15:30	60	37	0.4	4
R. Stratton, R. M. House, Stillwater, Oklahoma	15	16:05	17:05	60	57	0.1	4, 27
D. K. Ziegler, Pennsburg, Pa.	15	15:35	16:35	60	42	0.1	4
H. W. Bell, Paoli, Pennsylvania	15			45	11	...	4, 28
Miss B. F. Mumma, Waynesboro, Pennsylvania	15	14:45	17:30	165	48	...	4, 29
L. J. Scanlon,	14	14:15	14:30	15	4	0.1	
Pittsburgh, Pennsylvania	15	14:45	15:45	60	17	0.1	
W. B. Thompson, Shamokin, Pa.	15	15:00	18:00	180	113	...	4
R. W. Stone, Harrisburg, Pa.	15	15:50	16:20	30	8	...	
S. L. Coxe, Jr.,	14	13:40	14:35	55	4	0.4	13
Philadelphia, Pennsylvania	15	13:10	14:20	70	15	0.3	13 20
G. F. Gayer, Norwood, Pa.	15	14:08	14:38	30	4	0.1	
R. W. Miller, Lansdowne, Pa.	15	13:30	15:00	90	17	0.3	
Miss A. Williams,	13	13:00	17:00	240	53	0.4	30
Maryville, Tennessee	14	12:00	17:00	300	130	0.4	30
	15	12:00	15:00	180	130	0.3	30
	17	12:00	16:00	240	19	0.1	30
J. B. Witherspoon, Weatherford, Texas	15	15:00±	17:00	120±	100±	...	3
Mrs. F. O. Hester, San Angelo, Texas	15	15:30	17:00	90	20	...	31
W. B. Hales, Provo, Utah	16	15:30	17:30	120	135	...	32
W. S. Mory,	14	14:00	15:00	60	2	...	4
Waynesboro, Virginia	15	17:00	18:00	60	31	...	4
P. R. Bunch,	15	12:15	15:15	180	435	0.3?	4, 33
East Radford, Virginia	15	12:15	15:15	180	303	0.3?	4, 34
	16	8:30	9:20	50	103	...	4, 35
Miss H. H. Fillinger,	15	14:30	17:45	195	130	0.4?	3, 36
Hollius, Virginia	16	14:00	17:30	210	65	0.4?	
C. A. Nurell, Seattle, Wash.	15	16:	18:	...	..	0.2	37
Mrs. C. Brown, Seattle, Wash.	15	16:		5	6	0.2?	
Ray Colvin, Seattle, Wash.	15	14:30		...	..	0.1	38
William Cohn, Seattle, Wash.	15	14:15	14:45	30	149	0.1	
Hawaii: (Students of Miss L. M. Larrabee's)							
R. Okazaki, Honolulu	15	9:30	18:00	510	6	0.1	4
Miss M. Wong, Honolulu	12	11:30	12:00	30	1	<0.1	4
N. Nishimura, Honolulu	16	12:00	14:00	120	1	<0.1	4
H. Shiraishi, Honolulu	18	16:30	17:30	60	4	0.4	4
India:							
M. A. R. Khan,	11	23:00	00:00	60	10	...	4
Begumpet, Deccan, N.S.R.	12	21:30	22:20	50	3	0.4	4
(G.C.T.)		23:45	00:15	30	6	0.4	4
	13	23:45	00:15	30	2	...	4
	14	23:45	00:45	60	7	...	4
New Zealand:	16	20:50	22:00	70	20	0.1	4
R. A. McIntosh, Auckland	15	14:51	16:00	69	6		
	17	14:30	16:00	90	2		

REMARKS.

1. Count. Leonids only.
2. Records of each. Scattered clouds after 15:10.
3. Group of observers.
4. Count.
5. Four Leonids.

6. Three Leonids.
7. 64 Leonids.
8. 91 Leonids.
9. 201 Leonids.
10. 31 Leonids.
11. 25 Leonids.
12. Eight Leonids.
13. Count, records of each.
14. Four observers.
15. 11 observers working in shifts of 4 to 6. Duplicates included in count.
16. 10 observers working in shifts of 4. Duplicates included in count.
17. 93 Leonids. 4 observers working 3 at a time. 93 plotted by 4 other observers during same period.
18. All Leonids. No sporadic meteors seen.
19. Two observers, from window.
20. Two observers.
21. Four Leonids.
22. Twelve Leonids.
23. 44 Leonids.
24. Group of 25 observers.
25. Members of party organized by J. S. Allen.
26. Group of observers working in shifts of 3.
27. Two observers, duplicates not included.
28. Facing SW. from window.
29. From North window.
30. Count by 30 observers working in shifts of six.
31. From East window.
32. Five or six observers. 90% Leonids. 115 plotted.
33. Eighteen observers working independently. Evans Biology Club.
34. Three observers in different directions. No duplicates.
35. 3 observers working independently.
36. No duplicates.
37. "263 per second."
38. "Numerous flashes through haze."

Flower Observatory, Upper Darby, Pennsylvania, 1932 December 19.

Recent Meteoric Falls (Second List)

By C. C. WYLIE

METEORITES.

(1) BEARDSLEY, Kansas, October 15, 1929, 11:30 P.M.
(2) BALD MT., North Carolina, July 9, 1929.
(3) MILLER, Arkansas, July 13, 1930.
(4) ARCHIE, Missouri, August 10, 1932, 4:30 P.M.

The BEARDSLEY meteor was reported by us in POPULAR ASTRONOMY, Vol. 37, p. 605, 1929, and was referred to again on page 24 of our Contribution No. 1. These first notes refer to reports received from observers in Nebraska. We are indebted to Mr. H. H. Nininger of Denver, Colorado, for the information that the stones recovered are authentic meteorites. Mr. Nininger has recently completed a book on meteorites which is now in press. We are also indebted to Mr. Nininger for the information that authentic meteorites were recovered at Bald Mt., North Carolina, and Miller, Arkansas.

The ARCHIE meteor has not been previously announced. Our first report on this meteor was received from Mr. Thomas M. Galey of Independence, Kansas, who promptly sent us a clipping from the Kansas City Star of August 11, giving the reports of several observers of this daylight meteor. Later clippings gave us the information that Professor E. S. Haynes of the University of Missouri had visited Archie on August 12 to inspect the supposed meteorites, and interview observers of the meteor. Subsequently, Professor Haynes obtained more than eighty reports from observers of the meteor and we received several, the most distant being an observation we received from Fontanelle, Iowa. On our recent trip to Arizona, we visited Professor Haynes at Columbia, Missouri, and obtained the names of several persons who had observed the meteor. A number of these were

interviewed by us, standing exactly where they were when the meteor was seen, and in this way, information was obtained for a reasonably good determination of the path through the atmosphere. Five, possibly six, meteorites were recovered near Archie.

This list follows that printed in the June-July, 1930, issue of POPULAR ASTRONOMY, and appearing on page 28 of our Contribution No. 1. We may add that Mr. R. N. Buckstaff of Oshkosh, Wisconsin, sent us the information that the Pitts, Georgia, fall was stony-iron rather than iron. Our listing followed Merrill and Prior, and we had not noticed the correction published later that those meteorites should not be listed as iron.

DETONATING METEORS.

(1) VANDALIA, Illinois, December 8, 1930, 5:00 P.M.
(2) KENDRICK, Idaho, December 24, 1930, 9:45 P.M.
(3) BIRD CITY, Kansas, February 16, 1931, 10:30 A.M.
(4) CHEYENNE, Wyoming, February 16, 1931, 9:00 P.M.
(5) REDWOOD FALLS, Minnesota, August 4, 1931, 7:55 P.M.
(6) ELY, Nevada, July, 1932.
(7) MARSHFIELD, Wisconsin, August 22, 1932, 8:25 P.M.

For all of these meteors, the brilliancy and the detonations make it appear possible that meteorites actually reached the earth. The first of these, the Vandalia meteor, is referred to on page 63 of our Contribution No. 2. The second of these, the Kendrick, Idaho, meteor, is referred to on page 64 of the same contribution. For the information on the third and fourth of these detonating meteors, we are indebted to Mr. Nininger. The fifth meteor, the Redwood Falls, is referred to on page 77 of our Contribution No. 2. For the sixth meteor, Ely, Nevada, we are again indebted to Mr. Nininger, who reports that he has interviewed observers on the spot, but that he is not as yet certain of the exact date.

The seventh meteor, MARSHFIELD, Wisconsin, has not been previously reported. This meteor lighted up the state of Wisconsin, and portions of the adjoining states of Iowa, Illinois, Minnesota, and Michigan. Its brilliancy is indicated by the fact that two reports were received from residents of Iowa City within less than an hour of the time of the falling of the meteor. Detonations were reported from points more than fifty miles from Marshfield. Several accounts of the finding of supposed meteorites have reached us, but so far none has proved genuine on investigation.

University of Iowa, December 22, 1932.

Dubuque Counts of the 1932 Leonids

A selected group of students of Columbia College organized again this year, as in the last three years, for a systematic count of the Leonid meteors. The purpose of the count was to determine the width of the stream and also the density of the different parts of the stream. The program called for observations to begin on November 12 (noon-to-noon reckoning) and to continue until the end of the shower. The students were to keep a group count covering the entire sky, and in addition one member of the group was to keep a solo count recording his counts as an individual observer. Practically all of the observers had previous experience in counting meteors, and for most of them this was their fourth participation in observing meteor showers.

Throughout the entire period of the shower the moon was very troublesome.

Apart from moon interference the trying circumstance of clouds, as met with in previous years, afforded about an even break this year. The morning of November 12 was cloudy and no observations were made. On November 13 the sky was fair, though clouds and haze did hamper observation. Counts on this morning indicated that the shower was already showing some activity. On November 14 it was cloudy and no observations were possible. The morning of November 15 was perfectly clear and the total count for the group, watching the entire sky, was 512 Leonids for the period of 5 hours and 15 minutes from midnight to 17:15. A solo observer recorded 173 Leonids for this same period. The highest rate was reached around 16:00 o'clock when meteors fell at the rate of 240 an hour for the group and 92 an hour for the solo observer. November 16 was again cloudy. On November 17 sky conditions were fair but counts showed that the shower had nearly spent itself. No further observations were made as it was felt that the shower was practically over.

At the suggestion of Professor Wylie, of the University of Iowa, scores of observers were enlisted to watch the sky the entire forenoon of November 15 (November 16 Civil Time) for possible daylight meteors. Most observers reported that they had not seen any, while a few claimed some success and a total of five daylight meteors were reported for this period. The first was seen by two students of Clarke College, Dubuque, at 19:30. The second was recorded by P. Reiner, a student of Columbia Academy, Dubuque, at 21:01. The third was observed by a student of Clarke College at 21:45. The fourth was noticed by Russell Stotesberry of the Irving School at 23:00, and the fifth was seen at 23:20 by William Connors likewise of the Irving School. In each case the reports came from persons who were actually watching the sky for daylight meteors. In no case were there duplicate observations for any of the daylight meteors reported.

The following are the detailed reports of the Dubuque counts of the 1932 Leonids. The times are noon-to-noon reckoning and for the 90th meridian.

COLUMBIA COLLEGE COUNT.

1932	Began	Ended	Min.	Group Count	No. in Group	Solo Count	Solo Obs.	Brighter Than Jupiter	Rem.
Nov. 13	15:30	15:50	20	..	..	4	AJ	1	2
	16:30	16:45	15	3	4	2	AJ	0	2
	16:45	17:00	15	2	4	2	AJ	1	2
	17:00	17:15	15	3	4	1	AJ	0	3
	17:15	17:30	15	2	4	2	AJ	0	4
Nov. 14	No Observations—clouds								
Nov. 15	12:00	12:15	15	8	8	2	AJ	0	1
	12:15	12:30	15	16	8	9	AJ	0	1
	12:30	12:45	15	9	8	5	AJ	4	1
	12:45	13:00	15	11	8	6	AJ	1	1
	13:00	13:15	15	11	8	5	AJ	2	1
	13:15	13:30	15	11	8	4	AJ	1	1
	13:30	13:45	15	24	8	13	AJ	5	1
	13:45	14:00	15	17	8	8	AJ	3	1
	14:00	14:15	15	15	5	5	MP	0	1
	14:15	14:30	15	27	5	5	MP	3	1
	14:30	14:45	15	27	5	10	MP	4	1
	14:45	15:00	15	19	5	4	MP	3	1
	15:00	15:15	15	14	5	4	MP	2	1
	15:15	15:30	15	25	5	5	MP	5	1
	15:30	15:45	15	32	5	8	MP	7	1
	15:45	16:00	15	60	5	23	MP	16	1

1932	Began	Ended	Min.	Group Count	No. in Group	Solo Count	Solo Obs.	Brighter Than Jupiter	Rem.
	16:00	16:15	15	29	6	9	MP	3	1
	16:15	16:30	15	23	6	7	MP	2	1
	16:30	16:45	15	37	6	7	MP	3	1
	16:45	17:00	15	39	6	9	MP	6	1
	17:00	17:15	15	38	6	15	MP	7	1
	17:15	17:30	15	20	6	10	MP	2	1
Nov. 16	No Observations—clouds								
Nov. 17	15:00	15:15	15	..	..	0	CS	0	2
	15:15	15:30	15	..	..	1	CS	0	2
	15:30	15:45	15	..	..	1	CS	0	2
	16:00	16:15	15	..	..	2	AJ	0	2
	16:15	16:30	15	..	..	0	AJ	0	2
	16:30	16:45	15	..	..	0	AJ	0	2

Remarks: 1—Sky clear. 2—Sky hazy and partly cloudy. 3—Sky quite cloudy. 4—Clouds thickening.

Solo Observers: AJ—Alvin Jaeger. MP—Melvin Petry. CS—Charles Seda.

Observers watching in two-hour relays: Alvin Jaeger, Melvin Petry, Charles Seda, Leonard Jaeger, Robert Ernsdorff, Edward Kurt, John Lambert, James McFadden, Merlin Maury, Gordon Saunders, Frank Schuetz, Robert Becker, Lester Cooling, Michael Cavanaugh, Victor Hand, Francis Kernan, Thomas Moran, Eugene Kevane.—Students of Columbia College.

Additional Leonid Counts Received at Columbia College.

1932	Obs.	No. in Group	Began	Ended	Min.	Total Leonids
Nov. 16	Ca	11	16:15	17:00	45	94
	Ca	11	17:15	17:45	30	33
	Cb	7	16:15	17:00	45	106
	SP	3	16:10	17:10	60	31
	JJ	1	16:10	17:10	60	26
	Ct	4	17:00	18:00	60	32
	Cr	1	15:45	17:30	105	9
	Cs	2	17:00	18:00	60	45
	Cs	2	18:00	18:14	14	7
	Re	4	15:35	16:35	60	36
	JB	1	16:00	17:00	60	35
	HD	1	16:10	17:10	60	14
	DU	1	12:45	14:00	75	37
	JC	1	12:30	13:15	45	11
	JC	1	15:45	16:15	30	15
	JC	1	16:30	17:00	30	21
	JC	1	17:15	17:45	30	15
	LS	1	15:00	17:00	120	60
	SB	1	16:00	17:30	90	17

Observers:

Ca—Oliver Ludescher, Harold Lange, Oliver Goodman, B. Noonan, B. Hughes, F. Gilloon, K. Mentzer, G. Dorrington, C. Marek, M. O'Leary, C. Van Driel.—Students of Columbia Academy under the direction of Father Peters.

Cb—E. Wright, B. Clauer, J. Walsh, P. Hubher, J. Morrison, J. Evans, P. Reiner. —Students of Columbia Academy under the direction of Father Peters.

SP—Joseph Janning, Ralph Broker, Thomas Flood, students at St. Paul, Minn.

JJ—Joseph Janning, student at St. Paul, Minn.

Ct—Four observers at Clarke College watched from window.

Cr—Solo observer at Clarke College watched from window.

Cs—Misses Vincenza Manjoine and Albertina Pena, students at Clarke College.

Re—Four observers at Remsen, Iowa.

JB—James D. Burke at Shullburg, Wisconsin.

HD—Miss Hilda Dieterich watched from window.
DU—Miss Dorothy Urbain at Worthington, Iowa.
JC—James Casey, high school student at Bankston, Iowa.
LS—Miss Lenore Steffen, high school student, Bankston, Iowa.
SB—High school teacher at Bankston, Iowa.

JOHN A. THEOBALD.

Columbia College, Dubuque, Iowa.

Comet Notes

By G. VAN BIESBROECK

COMET 1932 *n* (DODWELL). The year 1932 will have been marked by a record of cometary activity: with the recovery of periodic comet Brooks (1932 *m*) a larger number of cometary discoveries had already been made this year than in any previous one. And now one more discovery has just been reported. On December 18 the telegraphic service of the Harvard College Observatory sent out the following message:

Comet Dodwell (Adelaide)

Dec. 17.0417 U.T.	$23^h\ 2^m\ 24^s$	$-28°\ 43'$
Daily motion	$+3\ \ 16$	$\pm\ 0\ \ 47$

Possibly Tempel

There was no indication of brightness but the sign of the motion in declination was ambiguous. There is evidently some error in the time-reckoning since the hour given corresponds to 10:00 A.M. for Adelaide; probably the astronomical time beginning at Greenwich noon, which was changed in 1925 to Universal Time beginning at midnight Greenwich, has been used instead of the latter.

Owing to the far southern declination the object which was situated near Fomalhaut at discovery does not seem to have been observed much at the northern observatories. At the time of writing the following observations have been broadcast:

	h m s	° ′ ″	M	
Dec. 19.0212 U.T.	23 7 45.0	−27 41 33	11	Whipple & Cunningham
19.9925	23 11 8.31	−26 57 38.5	9	Van Biesbroeck
21.9927	23 18 3.28	−25 25 47.3	10	Van Biesbroeck

The object was quite easily picked up here on the first clear night. Its appearance is illustrated here from a plate exposed for 20 minutes at the 24-inch reflector on December 20.003 U.T. There is no indication of a tail; the coma is round, about 3′ in diameter and centrally condensed, but no stellar nucleus was noticed. The total brightness was compared extrafocally with a pair of stars in the Cordoba Durchmusterung: the resulting magnitude was 9.4, which would be $10^M.6$ on the Harvard scale. Since the apparent motion is northeast the visibility will improve for observers on this side of the equator but the data are not available for predicting if the brightness will increase. The suspected identity of this object with Tempel's Comet is not very probable. Various assumptions as to the time of perihelion were tried but none bring the computed position within ten degrees of the observed place. Not until an orbit can be established for the newly found comet can this question be finally settled.

From *Harvard College Observatory Announcement Card*, 251, issued after the above was written, we have the following additional information concerning Comet Dodwell:

Elements of the comet have been computed as follows by Dr. Whipple and

Mr. Cunningham (a), who also have computed the ephemeris, and by Mr. Bobone of Cordoba (b):

ELEMENTS.

	(a)	(b)
T	December 30.57	December 29.79
ω	327° 18′.1	326° 18′
Ω	79° 53′.0	76° 8′
i	23° 51′.8	24° 57′
q	1.1002	1.152
e	0.7470	
P	9.07 years	

COMET DODWELL ON DECEMBER 20, 1932.

EPHEMERIS.

U.T.		α 1932.0 h m s	δ 1932.0 ° ′	ρ	r	Mag.
1932 Dec.	23.0	23 21 33	—24 38.7	0.908	1.105	10.00
	27.0	23 35 27	—21 22.6	0.896	1.099	
	31.0	23 49 24	—17 56.2	0.887	1.100	
1933 Jan.	4.0	0 3 25	—14 20.1	0.880	1.102	9.84

As the year draws to its close several of the numerous comets found in previous months are still under observation but all of them are faint and losing in brightness.

After sunset COMET 1932*e* (PERIODIC KOPFF) can still be seen in the constellation of Aquarius. In the middle of December I estimated the magnitude as 15; it appeared then as a faint round coma about 1′ in diameter with a feeble central condensation. F. Kepinski gives the continuation of the ephemeris for the beginning of the year:

EPHEMERIS OF COMET KOPFF.

0^h U.T.	α h m	δ ° ′	—Distance from— Earth	Sun
1933 Jan. 3	21 50.7	−5 49		
7	59.3	−5 5	2.11	2.70
11	22 7.8	−4 20		
15	16.2	−3 36		
19	24.5	−2 50		
23	32.7	−2 5	2.19	2.90
27	40.8	−1 19		
31	48.8	−0 33		
Feb. 4	56.7	+0 13		
8	23 4.5	+1 0	2.28	3.09

The correction of the ephemeris is quite small. The increasing distances will reduce the brightness so much that the comet will probably be out of reach before the end of January.

COMET 1932*f* (NEWMAN) is also an evening object but it will remain well situated. It will move rapidly from Cygnus through Lacerta into Andromeda. On the basis of parabolic elements computed by Schmitt I have continued the ephemeris as follows:

EPHEMERIS OF COMET NEWMAN.

0^h U.T.	α h m	δ ° ′	—Distance from— Earth	Sun
1933 Jan. 0	21 33.4	+51 49	1.94	2.08
8	22 15.2	50 43		
16	22 52.8	49 18	2.14	2.21
24	23 26.4	47 42		
Feb. 1	23 56.1	46 4	2.40	2.35
9	0 22.5	44 30		
17	0 46.2	43 3	2.70	2.49
25	1 7.5	41 43		
Mar. 5	1 26.9	40 33	3.03	2.64

When last observed here, December 15, the magnitude was estimated at 13.5. The decrease in brightness will proceed a little faster in January.

Both COMETS 1932*l* (PERIODIC FAYE) and 1932*m* (PERIODIC BROOKS) are situated in Cetus near the meridian in the first part of the night. The first one, the brighter of the two, will easily be followed for a couple of months hence; the second one is about two magnitudes fainter and will be lost sooner. For comet Faye Crommelin gives the following ephemeris in the 1933 *Handbook of the British Astronomical Association*:

EPHEMERIS OF COMET FAYE.

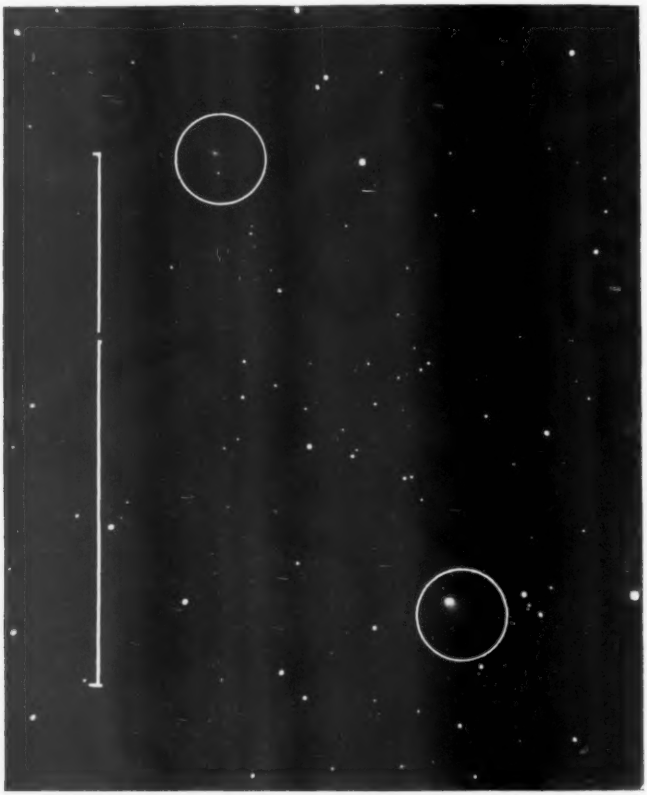
0^h U.T.	α h m s	δ ° ′	—Distance from— Earth	Sun
1933 Jan. 7	2 1 37	+ 2 0	1.65	1.13
15	2 18 24	3 7		
23	2 35 47	4 20	1.69	1.29
31	2 53 42	5 37		
Feb. 8	3 11 51	6 53	1.74	1.46
16	3 30 20	8 7		
24	3 48 51	9 18	1.81	1.65
Mar. 4	4 7 23	10 23		
12	4 25 57	11 21	1.88	1.86
20	4 44 36	12 13		
28	5 3 11	12 56	1.96	2.08
Apr. 5	5 21 33	13 32		

I have extended the ephemeris of Comet Brooks assuming 1932 October 9.5 for the date of perihelion:

EPHEMERIS OF COMET BROOKS.

0^h U.T.	α h m s	δ ° ′	—Distance from— Earth	Sun
1933 Jan. 7	1 37 32	+ 4 20	1.64	2.04
15	1 49 45	5 15		
23	2 2 36	6 50	1.86	2.08
31	16 0	8 7		
Feb. 8	29 47	9 22	2.09	2.14
16	43 57	10 36		
24	2 58 27	11 48	2.32	2.20
Mar. 4	3 13 12	12 55		
12	28 7	13 58	2.56	2.27
20	43 14	14 57		
28	58 32	15 49	2.79	2.36

As was foreseen, on November 28 Comets Faye and Brooks appeared quite close together in the sky. Their appearance on a plate exposed here for 20 minutes with



PERIODIC COMETS FAYE AND BROOKS ON NOVEMBER 28, 1932.

the 24-inch reflector is illustrated. The scale on the side represents an arc of 30′. It will be seen that the separation of the two comets was a little less than half a degree, a most unusual occurrence. This plate gives a good illustration of the relative brightness of the two objects: the magnitudes were estimated as 11th and 13th. Except for this difference in brightness the two comets look quite similar: they both show a diffuse coma with a little tail extending in the first quadrant.

In the second half of the night Comet 1932 *h* (Peltier-Whipple) is now too faint for being recorded. It was last photographed here on November 26 and 30 when it appeared as a vague small coma not brighter than a star of magnitude 17.

The region of periodic Comet 1925 II (Schwassmann-Wachmann) has been photographed here at the end of November but this object has not yet been found; so far it is evidently very faint at this opposition.

Periodic Comet Borrelly (1932 *k*) remains well accessible in the constellation of Canes Venatici. At the end of November it had gone down to 13th magnitude but still showed a little tail in the fourth quadrant.

Ephemeris of Comet Borrelly.

	α	δ	—Distance from—	
0^h U.T.	h m s	° ′	Earth	Sun
1932 Dec. 30	12 53 30	+35 6	1.51	1.94
1933 Jan. 7	13 3 54	36 42		
15	11 48	38 28	1.50	2.05
23	16 50	40 21		
31	19 23	42 13	1.50	2.18
Feb. 8	17 51	44 10		
16	13 40	45 54	1.54	2.27
24	13 6 32	47 20		
Mar. 4	12 56 16	48 40	1.61	2.38
12	45 50	49 0		
20	34 6	49 6	1.73	2.50
28	12 22 47	48 42		

A new-comer as far as the northern observers are concerned is Comet 1932 *g* (Geddes). It was observed by the writer using the 40-inch telescope on the morning of December 18 as a diffuse coma; the moon interfered with the observation and the brightness was difficult to estimate. The magnitude was, however, recorded as 11th. The coma seemed elongated in position angle 190° suggesting the presence of a short tail; but dark sky has to be awaited for confirming this. The object appeared exactly in the position indicated by the ephemeris on p. 628 of the December issue.

In the course of 1933 the reapparition of four periodic comets is expected. The search for the first of these, namely Comet Pons-Winnecke, can be started in January with the help of the following ephemeris by Crommelin (*Handbook for 1933 of the British Astronomical Association*), under two assumptions of the time of perihelion:

	T assumed May 15.0		T assumed May 21.0	
0^h U.T.	h m s	° ′	h m s	° ′
1933 Jan. 3	13 54 39	+10 7	13 44 52	+11 21
9	14 8 33	9 42	13 58 9	11 3
15	14 23 11	9 19	14 11 48	10 49
21	14 38 16	8 59	14 26 1	10 37
27	14 53 53	8 42	14 40 40	10 30
Feb. 2	15 10 13	8 27	14 55 54	10 26

Williams Bay, Wisconsin, 1932 December 21.

Notes from Amateurs

Astrolab — Chicago

There are numerous amateur telescope makers throughout the United States doing laboratory experimentation in optics relating primarily to Astronomy. We, of the newly named group—Astrolab—have found that by exchanging ideas on testing, technique in grinding and polishing, tricks of silvering, and the like have been able to make a better mirror in a shorter time than we should have otherwise. Many amateurs and amateur groups from all over the country have contributed their experiences to the mutual advantage of all of us. So far this exchange has been carried on for the most part by round robin letters, and by means of a bulletin, the Astroscope, published not more often than once a month.

McCarthy of the Los Angeles group was the first to broach the idea of a national medium of exchange to George Croston, who circulated the thought. Astrolab, an outgrowth of this idea, is an effort, therefore, to save amateurs much of the anguish we have incurred in our first attempts and also to avoid as much as possible a repetition of such pain to us in all future procedures.

If you are building a telescope, have built one or more, have one, or are thinking of constructing one for yourself, why not join with the rest of us, and help us roll the instrument ball together? A brief plan of "Astrolab" is as follows:

(1) To experiment in coöperation with various amateurs throughout the country in the investigation of various new practices to find out if these developments are of value in the advancement of optics particularly as they apply to astronomy.

(2) Such of these ideas as seem to be of an advanced nature will be adopted as a standard practice.

The first step in this program of amateur standardization is for portable telescopes—something you can put in the back of the car, and take with you when you want to do some real observing away from the interference of the arc light across the street.

The preferred focal lengths at present are 18 inches, 36 inches, and 6 feet, although any mirrors from 48 inches to 72 inches focal length will be capable of fitting into the standard program. The first essential, of course, is a standard polar axis bearing so that various fork type mountings can be interchangably used among amateurs of widely separated localities. A second step should be an interchangable mirror cell for the same purpose—amateur comparison of "seeing qualities of the mirrors."

The fork type of mounting because of its inherent self balancing which makes for the utmost convenience is the standard adopted. The center of gravity will be kept at the lowest possible point—the bearing points on the polar axis will be as widely separated as possible and will be three point bearings. The polar axis will probably be built of cast iron or steel, but may be of aluminum or wood. The fork will be of steel where the user does not object to the increased weight. Hour circles will be an integral part of the design, easily adjusted to star time. The declination ring will have two large bearings with provision to mount auxiliary equipment on both sides of the tube. This tube will consist of four longitudinal pieces of T bar or tubular cross section. Spacers will be cast aluminum rings with extended bearing surfaces where connected to the four longitudinal pieces in order to have maximum rigidity.

This design is the collective idea of a number of amateurs throughout the country and will be submitted to all interested coöperating persons for their approval and suggested changes before actually going into production.

These telescope parts are to be available from a supply department and members are invited to list any articles they wish to exchange or sell to other amateurs. Already there are a number of things for exchange. These should be of especial interest to beginning amateurs. Certain members should like particularly to coöperate with boy scouts, students, and groups now organizing, as they feel by working with them and helping them to build a 4-inch telescope of 18 and 36-inch focus they will enable more interested workers to contribute to amateur observation and will also stimulate an ever widening interest in astronomy.

Some of the parts now available are: ¾-inch x 1-inch prisms, ¾-inch Kellner eyepieces unmounted, fine ground mirror blanks of all sizes up to 11 inches diameter, ground to standard foci and ready for polishing. This latter item, we hope will be of especial value to the potential mirror maker who hasn't the time or the space to walk around the "barrel." One of our members has developed a pan method of polishing that makes it possible to work in a very small space, to sit down as you work, and by using white rouge, to do your polishing while waiting for a possible customer, a class, or perhaps a patient.

If you have a small lathe suitable for mounting eyepieces or making wooden patterns and would be interested in mounting some of these Kellners for other amateurs, let us know. It is hoped through this central exchange to reduce costs to those amateurs who wish to use this service.

Correspondence is invited by the staff of the "Astroscope" and members of "Astrolab." The organization issue of this publication may be obtained by sending a self-addressed envelope to the writer. L. I. Buttles.

10728 S. Artesian Avenue, Chicago, Illinois. November 14, 1932.

The Amateur Telescope Makers of Chicago

At the regular monthly meeting of the Amateur Telescope Makers of Chicago, held at the Adler Planetarium on December 4, Mr. F. W. Schlesinger described some of the work which amateur astronomers can do with simple apparatus. Systematic observations of sunspots and prominences of the chromosphere, timing occultations by the moon, examination of the surfaces of the planets were mentioned.

Mr. Charles W. Eliason, Jr., spoke on variable star observing and described some of the methods of doing so with the charts furnished by the A.A.V.S.O.

Professor Arthur Howe Carpenter advised the members to undertake some systematic work with their instruments as that is the only way to keep increasing their interest and enthusiasm. Wm. Callum, *Secretary*.

Zodiacal Light Notes

By W. E. GLANVILLE

Foreign Communications. Mr. A. F. I. Forbes, well-known comet hunter, Hermanus, South Africa, reports that the morning Zodiacal Light was not visible at his station during October. Weather conditions were favorable. Mr. J. Fraser Paterson, Broken Hill, New South Wales, Australia, writes that during April and May he had no success in seeing the evening Zodiacal Light notwithstanding a succession of clear skies during those months. During September and October he observed it on seven favorable evenings. On October 1 it presented the usual

triangular appearance between 7:00 and 9:00 P.M. At 11:00 P.M. he found that it extended as a *faint band* 5° wide from Sagittarius clear across the sky to the Hyades. He looked for the band on subsequent evenings but clouds interfered.

MORNING ZODIACAL LIGHT. From November 28 to December 7 inclusive the writer observed the morning Zodiacal Light, the sky being perfectly clear on each morning. The observations were made between 4:30 and 5:30 A.M. Jupiter in Leo prevented determination of the apex and towards 5:00 A.M. Venus, brilliant in Libra, scattered the Light in the horizon area. At 4:30 the space between Arcturus and Spica, then near the horizon, was well filled with the Light; at 5:30 the space was about half filled, Spica marking the sharply defined south boundary. On December 3 at 4:50 occasional pulsations were noticed due perhaps to atmospheric agitation. They moved from east to west like the fitful rippling of a pennant in a breeze.

EVENING ZODIACAL LIGHT. On December 15 at 6:20 P.M. the evening Light passed north of Alpha in Capricornus thence slightly north of Beta in Aquarius to Theta in Aquarius around to Delta in Capricornus to the horizon where the spread was about 20 degrees. The sky was clear and the Light distinct but faint.

The writer would like to enlist the interest of American observers especially of the evening Light best seen during the next three months. Information for making observations will be gladly given and all reports will be credited. Members of the Zodiacal Light sections in Japan and New Zealand will make a special study of the Gegenschein during the March equinox.

The Rectory, New Market, Maryland.

General Notes

Mr. David B. Pickering, who is well known to readers of POPULAR ASTRONOMY through his series of papers under the title "The Astronomical Fraternity of the World," gave an address before the Amateur Astronomers Association at the American Museum of Natural History, New York City, on December 21 on the subject "Personalities of the International Astronomical Union."

The Rittenhouse Astronomical Society

At its regular meeting held in Philadelphia on December 13 at The Franklin Institute, the Rittenhouse Astronomical Society elected the following officers for the year 1933: President, James Stokley, associate director, The Franklin Institute Museum; Vice-president, Professor William H. Barton, director, the Hyatt Observatory, Pennsylvania Military College; Secretary, Professor A. Clyde Schock, the Central High School of Philadelphia; Treasurer, S. W. Johnson, Swarthmore, Pennsylvania, and Member-at-large of Board of Governors, Dr. J. T. Rorer, William Penn High School.

The Society also adopted a new constitution, making a number of important changes in its policies, namely, the admission of women members; the division of the membership into two classes, active and associate; the creation of a Board of Governors to transact business of a routine nature, and the increase of the number of meetings to eight per year, held normally on the second Tuesday of each month from October to May. The Board of Governors will consist of the five officers listed above, and the two most recent past presidents, Dr. George Rosengarten, of the Philadelphia College of Pharmacy and Science, and Harry B. Rumrill, amateur astronomer of Berwyn, Pennsylvania.